Prepared for

United States Environmental Protection Agency
Region II
290 Broadway, 19th Floor
New York, New York 10007

YEAR 2 (2016) ANNUAL MONITORED NATURAL ATTENUATION REPORT

OPERABLE UNIT 3

Swope Oil and Chemical Superfund Site
Pennsauken Township, New Jersey

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May 2017

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EXECUTIVE SUMMARY

Geosyntec Consultants, Inc. (Geosyntec) has prepared this Year 2 (2016) Annual Monitored Natural Attenuation Report (Annual MNA Report) on behalf of the Swope Site Cleanup Committee (Committee) for the Swope Oil and Chemical Superfund Site (Site) in Pennsauken Township, New Jersey. This Annual MNA Report has been prepared to document activities completed in 2016 related to the Monitored Natural Attenuation (MNA) remedy for volatile organic compound (VOC) impacts to shallow groundwater (Operable Unit 3 [OU3]) at the Site, and to assess the progress of the OU3 remedy. The MNA remedy is being implemented in accordance with the OU3 Record of Decision (ROD). 2016 is the second year of OU3 MNA remedy implementation following the construction of a cap on the Site (Cap) to address shallow soil impacts (OU1).

The OU3 MNA remedy activities completed in 2016 include:

- Changing the deep well sampling method from Snap Samplers to passive diffusion bag samplers (PDBs) and updating the Quality Assurance Project Plan (QAPP) to reflect the change;
- Four (4) quarterly shallow aquifer sampling events and an annual deep aquifer sampling event;
- Collection of continuous shallow aquifer groundwater elevation data for one month preceding each of the quarterly shallow aquifer sampling events using programmable pressure transducers;
- Analysis of the transducer groundwater elevation data to establish the predominant flow pattern in the shallow aquifer for each of the quarterly shallow aquifer sampling events;
- Analysis of the shallow groundwater elevation data to assess whether the predominant flow pattern in the shallow aquifer could be established based on one week rather than one month of transducer data;
- Analysis of the shallow aquifer analytical data to evaluate groundwater quality trends with respect to Cap performance and off-Site source contributions; and
- Analysis of the shallow aquifer analytical data to assess whether conditions in the shallow aquifer continue to be conducive for the reductive dechlorination of chlorinated ethenes (i.e., tetrachloroethene [PCE], trichloroethene [TCE], cis-1,2-dichloroethene [cDCE], and vinyl chloride [VC]), and whether there is evidence that the natural attenuation of chlorinated ethenes is occurring.

The 2016 OU3 MNA remedy monitoring findings are as follows:

- The hydraulic gradient in the shallow aquifer at the Site is fairly flat with little variation in groundwater elevation between wells;
- Off-Site pumping stresses result in variability in the hydraulic gradient (both in direction and magnitude) in the vicinity of the Site resulting in distinct shallow aquifer groundwater flow patterns;
- The shallow aquifer groundwater flow patterns observed in 2016 are consistent with those observed historically, with the predominant shallow groundwater flow direction being onto the Site from the northeast and/or south, and the predominant groundwater flow direction off the Site being generally to the west with some variability to the north and southwest;
- Due to the stability of the shallow aquifer groundwater flow patterns, the predominant flow pattern in the shallow aquifer can be established based on one week of transducer data;
- PCE, TCE, and VC continue to be detected in the shallow aquifer in the vicinity of the Site at concentrations above the ROD performance standards, while cDCE continues to be detected below the ROD performance standard;
- Shallow aquifer monitoring wells located hydraulically upgradient of the Site, in particular MW-10S and GM-05S, continue to exhibit higher PCE, TCE, and cDCE concentrations relative to shallow aquifer monitoring wells located on-Site and proximally downgradient of the Site. The observed groundwater flow patterns and current contaminant distribution indicates that upgradient off-Site sources of PCE and TCE are impacting Site groundwater;
- Shallow aquifer geochemical conditions in the vicinity of the Site continue to be conducive to the reductive dechlorination of chlorinated ethenes. The presence of VC in wells on-Site and proximally downgradient of the Site indicates that reductive dechlorination is actively occurring in the vicinity of the Site;
- The potential for on-Site VOC sources to impact shallow groundwater has been mitigated by the implementation of remedial actions, and off-Site upgradient sources are now the predominant sources of VOCs to shallow groundwater beneath the Site. The attenuation of on-Site shallow aquifer PCE and TCE concentrations to the ROD performance standards is being inhibited by these area-wide groundwater conditions; and
- Deep groundwater analytical results indicate that regional VOC impacts continue to affect the on- and off-Site deep aquifer wells.

1. INTRODUCTION

1.1 Overview

This Annual MNA Report has been prepared to document activities completed in 2016 related to the MNA remedy for VOC impacts to shallow groundwater (OU3) at the Site, and to assess the progress of the OU3 remedy. 2016 is the second year of OU3 MNA remedy implementation.

This Annual MNA Report has been prepared in accordance with the following governing documents for the Site:

- Record of Decision, Swope Oil and Chemical Company Superfund Site, Operable Unit 3 – Groundwater Remediation, USEPA (OU3 ROD) (USEPA, 2010);
- *Final (100%) Remedial Design Report, OU3 Remedial Action*, Geosyntec (OU3 100% Design) (Geosyntec, 2013a);
- Remedial Action Work Plan, OU1/OU3 Remedial Action, Swope Superfund Site, Geosyntec (RAWP) (Geosyntec, 2014a);
- *Operation and Maintenance Plan, Swope Superfund Site*, Geosyntec (O&M Plan) (Geosyntec, 2014b); and
- *Remedial Action Report, OU1/OU3, Swope Superfund Site*, Geosyntec (RAR) (Geosyntec, 2015).

1.2 Report Organization

The remainder of this Annual MNA Report is organized as follows:

- Section 2: Project Background Information;
- Section 3: OU3 Remedy Overview;
- Section 4: 2016 OU3 MNA Remedy Activities;
- Section 5: Hydraulic Monitoring;
- Section 6: Groundwater Monitoring Results;
- Section 7: Data Usability;
- Section 8: Conclusions;
- Section 9: Recommendations; and
- Section 10: References.

2. PROJECT BACKGROUND INFORMATION

2.1 Site Description

The Site, United States Environmental Protection Agency (USEPA) ID#NJD041743220, is located at 8281 National Highway in an industrial area of Pennsauken Township, Camden County, New Jersey. The Site location is shown on **Figure 1**. The Site consists of an approximately 1.9-acre parcel of land where a chemical reclamation facility once operated. The current Site layout is shown on **Figure 2**. A chain link fence surrounds the Site. The Site is bounded to the north and east by railroad tracks and warehouses and to the southeast by National Highway. A property occupied by the Merchantville Pennsauken Water Commission (MPWC) abuts the Site to the west. The nearest residential areas to the Site are in the Townships of Delair and Morrisville, located about 0.5 miles west and 0.8 miles southeast of the Site, respectively.

2.2 Site History

Historical records indicate that the Site operated as a chemical reclamation facility from 1965 through 1979, reportedly handling solvents, oils, printing inks, phosphate esters, hydraulic fluids, paints, and varnishes. The Site is one of several sites in and around Pennsauken Township that have elevated levels of VOCs in the soil and groundwater as a result of historical industrial activities.

Several phases of soil and groundwater investigation and remediation have been implemented since the initiation of Site activities in 1985; the 2015 RAR (Geosyntec, 2015) provides a brief summary of these activities.

In 2014, a multi-layer impermeable Resource Conservation and Recovery Act (RCRA) cap was constructed over the entire Site (the Cap). The Cap was installed to address remaining VOC impacts to shallow soils (OU1) by reducing infiltration across the Site, thereby limiting VOC mass transfer from residual sources in the vadose zone to shallow groundwater. OU1 Cap construction was completed in July 2014 and was certified complete by USEPA in a letter dated 5 August 2014. In August 2014, following the completion of OU1 Cap construction, dedicated groundwater monitoring equipment was installed in the fourteen (14) shallow Site monitoring wells; the 2015 RAR (Geosyntec, 2015) describes these activities. The OU3 MNA remedy groundwater monitoring program was initiated in early 2015. The first year of OU3 MNA remedy implementation was documented in the *Year 1 (2015) Annual Monitored Natural Attenuation Report* (2015 Annual MNA Report) (Geosyntec, 2016b).

2.3 Conceptual Site Model

2.3.1 Hydrostratigraphy

The Site and regional hydrostratigraphy has been the subject of detailed investigations and evaluations for decades. A thorough discussion of the hydrostratigraphy is presented in the *Supplemental Investigation Report* (Geosyntec, 2009). As described in the OU3 100% Design (Geosyntec, 2013a), the subsurface hydrostratigraphy beneath the Site can be summarized as follows:

- The Site is underlain by the Potomac-Raritan-Magothy (PRM) aquifer system which consists of the three major hydrostratigraphic units: the Upper PRM, the Middle PRM, and the Lower PRM;
- The shallow water table aquifer (shallow aquifer) occurs in the Middle PRM (Raritan formation). The deep aquifer occurs in the Lower PRM (Potomac Group sediments). The Middle and Lower PRM are separated by an aquitard, which is approximately 35 feet thick beneath the Site, but varies in thickness regionally;
- Groundwater occurs under water table conditions in the Middle PRM unit at approximately 70 to 80 feet below ground surface (bgs) and under semi-confined to confined conditions within the Lower PRM unit at approximately 170 feet bgs; and
- The deep aquifer at the Site exists in the Lower PRM aquifer (Potomac Group sediments), and is separated from the shallow aquifer (Middle PRM) by an aquitard. The Potomac Group consists primarily of medium to coarse grained sand and gravel with some thin, discontinuous clay layers. The Potomac Group is approximately 70 feet thick in the vicinity of the Site and the Site deep monitoring wells were installed within this stratum.

2.3.2 Groundwater Flow Conditions

As described in the OU3 ROD (USEPA, 2010) and USEPA's most recent (2012) *Five-Year Review Report* for the Site (USEPA, 2012), the natural groundwater flow direction in the vicinity of the Site is northward towards the Delaware River. However, pumping induced gradients associated with groundwater withdrawals for water supply in Camden County have altered the groundwater flow patterns in both the shallow and deep aquifers in the vicinity of the Site. In general, groundwater flow in the deep aquifer has been consistently to the south under the influence of pumping wells near to Camden. Groundwater flow conditions in the shallow aquifer have been found to be more variable as they are strongly affected by changes in the pumping rates of nearby well fields.

Transducer studies conducted in 2008/2009 and in 2012 resolved historically conflicting groundwater flow interpretations that had been developed during the prior twenty-five year remedial investigation period and clarified the variable groundwater flow conditions in the shallow aquifer. Figures from the OU3 100% Design that illustrate the findings of the 2008/2009 and 2012 transducer studies are included in **Appendix A**.

The 2008/2009 and 2012 shallow aquifer transducer studies found that the hydraulic gradient in the shallow aquifer at the Site is fairly flat and groundwater flows slowly under the Site. The studies also found that groundwater in the shallow aquifer flows onto the Site from both the north and the south, and then converges and flows off the Site towards the west.

2.3.3 Historical Groundwater VOC Conditions

The OU3 100% Design (Geosyntec, 2013a) includes a detailed discussion of the historical Site groundwater VOC conditions (i.e., prior to the construction of the OU1 Cap). Tables and figures from the OU3 100% Design relevant to the historical Site groundwater VOC conditions are included in **Appendix A**.

2.3.3.1 Shallow Aquifer

VOCs, specifically PCE, TCE, and cDCE, have historically been detected at low levels in the shallow aquifer beneath the Site. These compounds have also been historically detected in wells located hydraulically upgradient from the Site. These regional VOC impacts have been well documented over decades of remedial investigations and in the OU3 ROD (USEPA, 2010), USEPA acknowledged that upgradient off-Site VOC sources contribute to the shallow groundwater impacts at the Site. The potential for on-Site soil VOC sources to impact shallow groundwater has been mitigated by the implementation of remedial actions, including the OU1 Cap, as described in the 2015 RAR (Geosyntec, 2015). It is anticipated that the low-level VOC concentrations in the shallow aquifer potentially associated with the Site will naturally attenuate, provided that these on-Site conditions are not exacerbated by off-Site or "background" groundwater conditions in the area. VOCs in shallow groundwater at upgradient locations serve as potential sources of VOCs to shallow groundwater beneath the Site.

2.3.3.2 Deep Aquifer

Deep aquifer groundwater monitoring wells upgradient of the Site have historically exhibited VOC concentrations greater than concentrations on or downgradient from the Site. As a result of these documented historical conditions, USEPA acknowledged that contaminants in the on-Site deep wells are likely the result of upgradient sources. Therefore, the OU3 ROD (USEPA, 2010) requires only yearly monitoring in the deep aquifer.

3. OU3 REMEDY OVERVIEW

3.1 Summary of the OU3 Remedy

The OU3 remedy was selected by USEPA with the concurrence of the New Jersey Department of Environmental Protection (NJDEP). The OU3 remedy presented in the OU3 ROD (USEPA, 2010) includes the following primary components:

1. MNA for the shallow aquifer;

2. Groundwater monitoring for the deep aquifer; and

3. Establishment of a Classification Exception Area (CEA), which is an institutional control, to minimize the potential for exposure to contaminated groundwater until the aquifer meets the cleanup goals.

The OU3 MNA remedy for shallow groundwater was initiated following the final inspection of the completed OU1 Cap. In August 2014, as described in the 2015 RAR, dedicated groundwater monitoring equipment was installed in the fourteen (14) shallow aquifer monitoring wells. The first OU3 MNA remedy shallow aquifer sampling event was completed in the first quarter (Q1) of 2015. Quarterly shallow aquifer sampling events were completed in 2015 and 2016, for a total of eight (8) rounds of groundwater sampling. As per the approved OU3 100% Design (Geosyntec, 2013a) and RAWP (Geosyntec, 2014a), 2017 will be the first year of semi-annual shallow aquifer sampling events.

The first annual deep aquifer sampling event was completed in October 2015 using Snap Sampler® passive groundwater sampling devices. In October 2016, the second annual deep aquifer sampling event was completed using passive diffusion bag samplers (PDBs). Future annual deep aquifer sampling events will also be completed using PDBs. As per the OU3 100% Design (Geosyntec, 2013a) and RAWP (Geosyntec, 2014a), the deep aquifer will continue to be monitored on an annual basis.

The application for the Site CEA was submitted as Appendix D of the RAWP (Geosyntec, 2014a), and the CEA was established by NJDEP effective 4 February 2014.

3.2 Performance Standards for the OU3 MNA Remedy

As per the OU3 ROD (USEPA, 2010), the applicable cleanup standards for the OU3 MNA remedy were identified as the lower of the State of New Jersey Class II-A Ground Water Quality Standards (NJGWQSs [II-A]) or the Federal Maximum Concentration Limits (MCLs) as set forth in Appendix II-A, Table 3. These standards are referred to herein as the "ROD performance standards".

Per the OU3 100% Design (Geosyntec, 2013a), PCE, TCE, cDCE, and VC are the primary Site COCs subject to the MNA performance evaluation.

USEPA acknowledged in the OU3 ROD (USEPA, 2010) that off-Site groundwater VOC sources exist in the immediate vicinity of the Site at levels above NJGWQSs. Section XII of the Statement of Work (i.e., Appendix A of the *Administrative Settlement Agreement and Order on Consent for the Development of the Remedial Design, Operable Unit 1* (USEPA, 2011a)) describes a process by which the Committee may propose to modify the performance standards.

3.3 Applicable or Relevant and Appropriate Regulations for OU3

Applicable State regulations include the NJDEP *Technical Requirements for Site Remediation* (TRSR) promulgated as N.J.A.C. 7:26E (NJDEP, 2012a). These regulations provide requirements for conducting remedial investigations and remedial actions at a site. The applicable State cleanup standards for groundwater at the Site are the NJGWQSs promulgated as N.J.A.C. 7:9C. These standards provide the basis for protection of ambient groundwater quality in New Jersey through the establishment of constituent standards for groundwater pollutants. They are equivalent to or more stringent than the Federal MCLs. MCLs are promulgated in the Safe Drinking Water Act (SDWA) under 40 CFR 141-149. Sampling protocols for collection of groundwater and other environmental media are outlined in NJDEP's *Field Sampling Procedures Manual* (FSPM) (NJDEP, 2005).

4. 2016 OU3 MNA REMEDY ACTIVITIES

4.1 Chronology and Description of Events

The table below summarizes the OU3 MNA remedy activities that were completed in 2016.

Date(s)	Description
February 22-23, 2016	Pre-Q1 shallow well sampling event transducer deployment
March 21-24, 2016	Q1 2016 shallow well sampling event[1]
July 8, 2016	Pre-Q2 shallow well sampling event transducer deployment
August 8-11, 2016	Q2 2016 shallow well sampling event
September 19, 2016	Pre-Q3 shallow well sampling event transducer deployment; deep well removal of Snap Samplers and PDB deployment
October 17-20, 2016	Q3 2016 shallow and deep well sampling event[2]
October 28, 2016	Pre-Q4 shallow well sampling event transducer deployment
November 28-December 1, 2016	Q4 2016 shallow well sampling event

4.2 QAPP Update

The QAPP for the Site was revised to reflect the change in the deep well sampling method from Snap Samplers to PDBs. The revised QAPP was submitted to USEPA in September 2016.

4.3 Shallow Aquifer MNA Quarterly Groundwater Sampling Events

Shallow aquifer MNA quarterly groundwater sampling events were completed in 2016 in March (Q1), August (Q2), October (Q3), and November/December (Q4). The quarterly sampling events were conducted in accordance with the OU3 100% Design (Geosyntec, 2013a), the RAWP (Geosyntec, 2014a), and the associated FSP and QAPP, as follows:

- Approximately one month prior to each sampling event, programmable pressure transducers (and a barometric pressure logger) were deployed in the shallow wells;
- A synoptic round of manual groundwater level gauging measurements was completed at the start of each quarterly shallow aquifer sampling event;

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[1] During the Q1 event, shallow wells MW-01, MW-04, MW-07, and MW-10S were split-sampled between Geosyntec and USEPA.
[2] During the Q3 event, shallow wells MW-01, MW-04, MW-07, and MW-10S were split-sampled between Geosyntec and USEPA.

- During each quarterly shallow aquifer sampling event, the fourteen (14) shallow wells comprising the Site-associated shallow aquifer monitoring well network were purged and sampled using the dedicated bladder pumps installed in each well and following NJDEP low-flow sampling protocols;
- During the purging of each shallow well, periodic measurements were made of the depth to groundwater as well as the following groundwater quality parameters: pH, temperature, specific conductance, dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity. Samples were collected from the shallow wells only after the groundwater quality parameters had stabilized to within ranges specified in the FSP; and
- During each quarterly shallow aquifer sampling event, the fourteen (14) Site-associated shallow wells were sampled for laboratory analysis of VOCs, 1,4-dioxane, iron and manganese (total and dissolved), total suspended solids (TSS), total alkalinity, dissolved hydrocarbon gases (methane, ethane, and ethene), total organic carbon (TOC), sulfate, and nitrate, by analytical methods specified in the QAPP.

The stabilized groundwater quality parameter measurements for each shallow well for each quarterly sampling event are summarized in **Table 1**. The monitoring well low-flow purging and sampling records from each quarterly sampling event are included in **Appendix B**. The 2016 laboratory analytical reports and data validation documentation are included in **Appendix C**.

4.4 Deep Aquifer Monitoring Activities

The first annual deep aquifer sampling event was completed in October 2015 using Snap Samplers®. However, the presence of fine sediment in deep well GM-01D and mechanical failures in other deep wells caused issues with the collection of some of the 2015 annual deep aquifer samples using the Snap Samplers®. These issues prompted the change in the deep well sampling method from Snap Samplers® to PDBs. The change was proposed to USEPA in a memorandum dated July 27, 2016 (**Appendix D**), and the change was approved by USEPA in a letter dated August 12, 2016 (**Appendix D**).

4.4.1 Snap Sampler Removal and PDB Deployment

On September 19, 2016, Geosyntec removed the Snap Samplers® and deployed one (1) 500 mL PDB in each of the eight (8) Site-associated deep wells. The PDBs were purchased from EON Products, Inc. (EON) of Snellville, Georgia and were supplied pre-filled with ASTM I deionized water. In accordance with the FSPM, prior to the deployment of a PDB in a deep well a manual groundwater level gauging measurement was collected. The PDBs were deployed in each of the deep wells in the middle of the screened interval using a one-time-use (i.e., disposable) polypropylene rope tether with a stainless-steel weight at the end. The stainless-steel weights were cleaned with a non-phosphate detergent and distilled water prior to deployment in the deep wells. On the day of PDB deployment, in accordance with the FSPM, a modified field blank sample (MFB) was collected for laboratory analysis of VOCs. The MFB was collected from a "blank" PDB that had been shipped along with the PDBs from EON. The blank PDB contained the same water that was used to pre-fill the PDBs that were deployed in the deep wells. The PDB deployment tasks were conducted in accordance with a Standard Operating Procedure (SOP) prepared by Geosyntec. The SOP, which was prepared in accordance with the FSPM, was included with the revised QAPP that was submitted to USEPA in September 2016 (Geosyntec, 2016a). The PDBs were left to equilibrate within the deep wells for one month prior to retrieval and sample collection.

4.4.2 Deep Aquifer Monitoring Annual Sampling Event

The 2016 annual deep aquifer monitoring sampling event was completed in October 2016. The PDBs were retrieved from the deep wells for sample collection between October 18 and 20, 2016. In accordance with the FSPM, a manual groundwater level gauging measurement was collected prior to the retrieval of a PDB from a deep well. Deep aquifer monitoring samples were collected from the PDBs following the procedures outlined in the SOP. The deep well samples were submitted for laboratory analysis of VOCs in accordance with the FSP and QAPP. Samples collected from deep wells GM-01D and GM-04D were split between Geosyntec and USEPA. The one-time-use polyethylene rope tethers were discarded after retrieval from the wells while the stainless-steel weights were decontaminated and retained for future use. The 2016 laboratory analytical reports and data validation documentation are included in **Appendix C**.

5. HYDRAULIC MONITORING

5.1 Groundwater Elevation Data Collection

5.1.1 Shallow Aquifer

As per the OU3 100% Design (Geosyntec, 2013a), programmable pressure transducers were used to collect instantaneous groundwater elevation measurements continuously at each of the fourteen (14) Site-associated shallow wells for one month preceding each shallow aquifer sampling event. The instantaneous groundwater elevation measurements were collected using Solinst Model 3001 Levelogger® pressure transducers. A Solinst Model 3001 Barologger® barometric pressure logger (baro logger) was deployed at the Site concurrently with the deployment of the pressure transducers in the shallow wells. Transducer and baro logger measurements were collected at a frequency of one measurement every 2 minutes for the 2016 Q1 shallow aquifer sampling event, and one measurement every 15 minutes for subsequent 2016 quarterly shallow aquifer sampling events.[3] The baro logger data were used to adjust the pressure transducer data for atmospheric pressure, allowing the transducer measurements, initially in units of pressure, to be converted to units of feet of hydraulic head above the sensor. The adjusted measurements were converted to groundwater elevation measurements using manual groundwater level gauging measurements collected at the time of transducer deployment. A synoptic round of manual groundwater level gauging measurements was collected at the beginning of each quarterly shallow well sampling event, prior to the commencement of purging and sampling activities. The 2016 shallow well groundwater level gauging measurements are summarized in **Table 2**.

5.1.2 Deep Aquifer

Manual groundwater level gauging measurements were collected at each of the eight (8) Site-associated deep aquifer monitoring wells prior to deployment and prior to retrieval of the PDBs used to collect the annual deep aquifer monitoring samples in October 2016. The 2016 deep well groundwater level gauging measurements are summarized in **Table 3**.

5.2 2016 Shallow Aquifer Groundwater Flow Conditions

5.2.1 Hydrograph Stability Analysis

Hydrographs of the 2016 quarterly shallow aquifer transducer data are presented on Figures 3a through 3.d. Geosyntec analyzed the 2016 shallow aquifer transducer datasets to assess the stability

[3] In three (3) cases in 2016, a transducer malfunctioned and the data could not be retrieved for analysis (i.e., the transducers deployed in GM-01S prior to the Q1 sampling event, and in GM-06S and GM-07S prior to the Q2 sampling event). The lack of this data did not significantly affect the analysis of the 2016 Q1 and Q2 shallow aquifer groundwater flow patterns.

of the shallow aquifer groundwater flow patterns and to evaluate whether the flow patterns could be established based on one week rather than one month of transducer data. The results of the flow pattern stability analysis were also used to create the 2016 quarterly shallow aquifer potentiometric surface maps and to establish the hydraulic positions of the shallow aquifer monitoring wells relative to the Site. The shallow aquifer groundwater flow pattern stability analysis results are included in **Appendix E**.

The shallow aquifer groundwater flow pattern stability analysis involved calculating weighted-average ranks of the groundwater elevation at each shallow aquifer monitoring well for each one-month period and for each of the four weeks within each month. The resulting patterns for each one-month period and each week within each month were found to be consistent, indicating that the shallow aquifer groundwater flow patterns were stable over each one-month period, and that therefore each week is representative of the month.

5.2.2 Shallow Well Transducer Deployment Time Analysis

Given that each week of transducer data was found to be representative of the month, it was concluded that the shallow aquifer groundwater flow pattern could be established based on one week rather than one month of transducer data. Geosyntec's transducer deployment time analysis was presented to USEPA, and in a December 8, 2016 email, Ms. Renee Gelblat, the USEPA Region 2 Remedial Project Manager for the Site, communicated that USEPA agreed with Geosyntec's findings and that deploying the transducers for only one week prior to each shallow aquifer sampling event is sufficient. Thus, going forward, programmable pressure transducers will be deployed in each of the fourteen (14) Site-associated shallow wells for one week instead of one month preceding each shallow aquifer sampling event.

5.2.3 Representative Shallow Aquifer Groundwater Flow Pattern Analysis

The results of the flow pattern stability analysis were used to create the 2016 quarterly shallow aquifer potentiometric surface maps presented in (**Figures 4a** through **4d)** based on a comparison of groundwater elevation data from each well and the monthly weighted average. Thus, the 2016 quarterly shallow aquifer potentiometric surface maps depict the groundwater flow pattern most representative of the quarterly transducer dataset (**Appendix E**).

Generally consistent with the findings of the 2008/2009 and 2012 transducer studies and the 2015 transducer data, the 2016 transducer data indicate the following:

- The hydraulic gradient in the shallow aquifer at the Site is fairly flat with little variation in groundwater elevation between wells;

- Off-Site pumping stresses result in variability in the hydraulic gradient (both in direction and magnitude) within the vicinity of the Site resulting in distinct groundwater flow patterns;
- The predominant direction of groundwater flow onto the Site is from the northeast (i.e., from the direction of GM-02S and GM-05S) and/or south (i.e., from the direction of MW-10S); and
- The predominant groundwater flow direction off the Site is generally to the west with some variability to the northwest and southwest.

On the basis of the analysis of the 2016 transducer data, the fourteen (14) Site-associated shallow aquifer monitoring wells were grouped based on their typical hydraulic position relative to the Site:

- On-Site wells: GM-01S, GM-03RS, MW-01, MW-02, and MW-04;
- Off-Site upgradient wells: GM-02S, GM-05S and MW-10S; and
- Off-Site downgradient/sidegradient wells: GM-06S, GM-07S, GM-08S, MW-07, MW-09S, and MW-11S.

The off-Site upgradient wells are those that have been observed to typically be upgradient from the Site, while the off-Site sidegradient/downgradient wells are those that have been observed to typically be downgradient or sidegradient from the Site. In a change from the 2015 classifications, in 2016 off-Site wells GM-06S and GM-07S are classified as downgradient/sidegradient rather than only sidegradient. All other 2016 classifications are consistent with 2015 classifications.

6. GROUNDWATER MONITORING RESULTS

6.1 Shallow Aquifer Groundwater Quality Parameters

In 2016, measurements of groundwater quality parameters including pH, temperature, specific conductance, dissolved oxygen (DO), oxidative-reduction potential (ORP), and turbidity were collected at each shallow well during each quarterly shallow well sampling event. The stabilized groundwater quality parameter values for each shallow well for each sampling event are presented in **Table 1.** The 2016 shallow aquifer groundwater quality parameter measurements were generally consistent with the 2015 measurements (**Table 1**).

6.2 Shallow Aquifer Geochemical Conditions

In 2016, the geochemical conditions present at each shallow well were evaluated at the time of each quarterly shallow well sampling event via the collection and analysis of groundwater samples for total and dissolved iron and manganese, TSS, alkalinity, dissolved hydrocarbon gases (methane, ethane, and ethene), TOC, sulfate, and nitrate. The geochemical parameter analytical results are presented in **Table 4** and on **Figure 5**.

The 2016 shallow aquifer geochemical analytical parameter results indicate the following:

- Iron and manganese primarily exist in the soluble (i.e., reduced) state, indicating the existence of reducing geochemical conditions;
- The presence of methane on-Site and at downgradient locations is an indicator of strongly reducing conditions as methanogenesis generally occurs only after the electron acceptors oxygen, nitrate, and sulfate have been depleted in groundwater. Of particular note, the concentrations of methane detected at on-Site well MW-02 in 2016 were over two orders of magnitude greater than the concentrations detected in 2015, indicating the existence of significantly methanogenic conditions in groundwater on-Site. This response is likely related to reduced infiltration as a result of the Cap.
- Ethane and ethene are the end products of reductive dechlorination of chlorinated ethanes/ethenes and have historically been and continue to be detected on-Site and at downgradient locations (**Appendix A** and **Table 4**). The highest concentrations of ethane and ethene detected in 2016 were greater than the highest concentrations detected in 2015, indicating the continued production of these end products by reductive dechlorination; and
- The predominance of dissolved iron and manganese in Site groundwater, and the presence of methane, ethane, and ethene on-Site and at downgradient locations are indicative of strongly reducing geochemical conditions that are conducive to the reductive dechlorination of PCE and TCE in the shallow aquifer.

6.3 Distribution of VOCs in Groundwater

Shallow and deep aquifer 2016 groundwater sample analytical results are summarized on **Tables 4** and **5**, and the analytical results for PCE, TCE, cDCE, and VC are presented on **Figures 5** and **6**. Isoconcentration maps illustrating the spatial distributions of PCE and TCE in the shallow aquifer for each 2016 quarterly sampling event are presented on **Figures 7a** through **10d**.[4] Note that isoconcentration contours were not drawn for PCE or VC because only low-level concentrations at or slightly above the ROD performance standards were detected.

6.3.1 Shallow Aquifer

6.3.1.1 PCE

In 2016, consistent with the results in 2015, PCE was detected slightly above the ROD performance standard of 1 µg/L at eleven (11) of the fourteen (14) shallow aquifer wells. At these eleven (11) wells, PCE concentrations ranged from 1.1 to 5.0 µg/L. PCE was not detected above the ROD performance standard at downgradient/sidegradient wells GM-07S, GM-08S, and MW-07. In 2016, the highest PCE concentrations were consistently detected at off-Site upgradient wells (i.e., MW-10S for Q1, Q3, and Q4, and GM-05S for Q2).

6.3.1.2 TCE

In 2016, TCE was detected above the ROD performance standard of 1 µg/L at all fourteen (14) of the shallow aquifer wells with concentrations ranging from 1.1 to 132 µg/L. Except for the Q2 sampling event, in 2016, consistent with 2015, the highest TCE concentrations were consistently detected at off-Site upgradient well MW-10S.

6.3.1.3 cDCE

In 2016, consistent with 2015, cDCE concentrations in the shallow aquifer were below the ROD performance standard of 70 µg/L at all locations. Except for the Q2 sampling event, in 2016, consistent with the results in 2015, the highest cDCE concentration was detected at off-Site upgradient well MW-10S. cDCE is an intermediate in the reductive dechlorination of PCE and TCE, and the presence of cDCE in shallow groundwater indicates that the reductive dechlorination of the parent compounds is occurring in the vicinity of the Site.

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[4] As noted in the OU3 100% Design (Geosyntec, 2013a), MW-01 is screened at a depth consistent with other shallow monitoring wells on-Site, whereas MW-02 is screened at a shallower interval. MW-02 had been slated for abandonment in favor of retaining MW-01, but variability between COC data for MW-01 and MW-02 deferred those plans. The higher concentration of each COC for MW-01 and MW-02 was used for isoconcentration contour figures in the OU3 100% Design; **Figures 7a** through **10d** follow this protocol.

6.3.1.4 VC

In 2016, consistent with the results in 2015, VC concentrations in the shallow aquifer were below the ROD performance standard of 1 µg/L at all on-Site locations. In 2016, VC was detected at off-Site downgradient/sidegradient well MW-09S in Q2 and off-Site upgradient well GM-02S in Q4 at concentrations slightly exceeding the ROD performance standard. VC is the last intermediate before the complete reductive dechlorination of PCE and TCE to ethene, and the presence of VC in shallow groundwater indicates that the reductive dechlorination of the parent compounds is occurring in the vicinity of the Site.

6.3.2 Deep Aquifer

The concentrations of VOCs detected in the deep aquifer in 2016 are consistent with those detected in 2015 (**Table 5**). The October 2016 deep aquifer sampling results can be summarized as follows:

- PCE was detected slightly above the NJGWQS of 1 µg/L in six (6) of the eight (8) deep aquifer wells. At these wells detected PCE concentrations ranged from 1.2 to 4.9 µg/L, with the highest concentration detected at off-Site well GM-03D;
- TCE was detected above the NJGWQS of 1 µg/L in seven (7) of the eight (8) deep aquifer wells. At these wells detected TCE concentrations ranged from 2.4 to 19 µg/L, with the highest concentration detected at off-Site well GM-08D; and
- cDCE was detected below the NJGWQS of 70 µg/L at all eight (8) deep aquifer wells.

The deep aquifer exists within the Lower PRM, which is separated from the shallow aquifer by an aquitard approximately 35 feet thick beneath the Site. The existence of PCE, TCE, and cDCE in the deep aquifer continues to indicate a more regional presence of VOC impacts.

6.4 Shallow Aquifer VOC Trend Analysis

In accordance with the OU3 100% Design (Geosyntec, 2013a), to evaluate OU3 MNA remedy progress, Geosyntec analyzed the post-Cap trends in shallow monitoring well VOC concentrations using the Mann-Kendall trend test and by calculation of first-order natural attenuation rates. These analyses are presented in **Tables 6** and **7** and **Appendices F** and **G**, respectively. For the on-Site wells, the analyses indicate an overall decreasing trend in PCE concentrations, an overall increasing trend in TCE concentrations, and no significant overall trend in cDCE or VC concentrations. Note that while TCE concentrations have generally shown an increasing trend since the construction of the Cap, historic concentrations show an overall decreasing trend. When these overall on-Site trends are evaluated in the context of the spatial concentration patterns and upgradient trends, as illustrated by time series plots for PCE, TCE, cDCE, and VC groundwater concentrations (**Figures 11a** through **14d**), it is concluded that the presence of upgradient sources of the VOC parent compounds are impacting groundwater quality on-Site.

The time series plots shown on **Figures 11a** through **14d** present the concentrations of PCE, TCE, cDCE, and VC detected at upgradient, on-Site, and downgradient/sidegradient monitoring wells since 2012 (i.e., beginning prior to the construction of the OU1 Cap in 2014). The "**a**" figures presents the highest concentrations of each VOC detected in an upgradient, on-Site, or downgradient/sidegradient shallow aquifer monitoring well by sampling event, while the "**b**", "**c**", and "**d**" figures present the concentrations of each VOC detected in individual upgradient, on-Site, or downgradient/sidegradient shallow aquifer monitoring wells, respectively, by sampling event.

6.4.1 PCE

The key findings of the analysis of the PCE time series plots are as follows:

- **Figure 11a** illustrates that the highest on-Site concentrations of PCE have decreased significantly since 2012, while the highest upgradient concentrations are increasing;
- **Figure 11a** also illustrates that in 2016 the highest upgradient concentrations of PCE were consistently greater than the highest on-Site or downgradient/sidegradient concentrations;
- **Figures 11b** and **11c** illustrate that in 2016 on-Site PCE concentrations were stable, while upgradient concentrations, on average, were increasing; and
- **Figure 11d** illustrates that in 2016 downgradient/sidegradient PCE concentrations were generally stable.

These results are consistent with the existence of sources of PCE upgradient of the Site that are continuing to impact groundwater beneath the Site. In addition, the decrease in on-Site PCE concentrations since 2012 indicates that the remedial actions have served to mitigate the impacts of on-Site sources of PCE on groundwater.

6.4.2 TCE

The key findings of the analysis of the TCE time series plots are as follows:

- **Figure 12a** illustrates that, with the exception of the 2016 Q2 sampling event, the highest upgradient concentrations of TCE have been consistently and significantly greater than the highest on-Site or downgradient/sidegradient concentrations;
- **Figure 12b** illustrates that TCE concentrations at upgradient well MW-10S south of the Site are consistently and significantly greater than the concentrations at upgradient wells GM-02S and GM-05S northeast of the Site;
- **Figure 12c** illustrates that the highest on-Site concentrations of TCE have consistently been detected at wells MW-04 and GM-03RS, which are the on-Site wells most proximally downgradient of MW-10S, and that, by well, on-Site TCE concentrations have remained fairly stable since prior to the construction of the Cap; and

- **Figure 12d** illustrates that in 2016 downgradient/sidegradient TCE concentrations were generally stable.

These results are consistent with the existence of a source of TCE upgradient and generally to the south of the Site (i.e., as evidenced by groundwater quality at well MW-10S) that is continuing to impact groundwater beneath the Site.

6.4.3 cDCE

The key findings of the analysis of the cDCE time series plots are as follows:

- **Figure 13a** illustrates that, with the exception of the 2016 Q2 sampling event, the highest upgradient concentrations of cDCE have been consistently greater than the highest on-Site or downgradient/sidegradient concentrations, and that concentrations of cDCE in shallow groundwater have remained below the ROD performance standard of 70 µg/L;
- **Figure 13b** illustrates that cDCE concentrations at upgradient well MW-10S south of the Site are consistently and significantly greater than the concentrations at upgradient wells GM-02S and GM-05S northeast of the Site;
- **Figure 13c** illustrates that the highest on-Site concentrations of cDCE have consistently been detected at well GM-03RS, which is the on-Site well most proximally downgradient of MW-10S; and
- **Figures 13c** and **13d** illustrate that since 2015, on-Site and downgradient/sidegradient cDCE concentrations have remained fairly stable.

Although cDCE concentrations have decreased since 2012, the recent stability of cDCE concentrations indicates that the reductive dechlorination of PCE and TCE is ongoing in the vicinity of the Site.

6.4.4 VC

The VC time series plots indicate that VC detections are low, are in some cases sporadic, and have been limited to only six (6) of the fourteen (14) Site shallow aquifer monitoring wells (i.e., upgradient well GM-02S, on-Site wells GM-03RS and MW-02, and downgradient/sidegradient wells GM-06S, GM-08S, and MW-09S) since 2012. In addition, the highest concentrations of VC have most often been detected at downgradient/sidegradient well MW-09S. The consistent detection of VC at upgradient well GM-02S and downgradient/sidegradient well MW-09S indicates that the reductive dechlorination of cDCE is consistently occurring in the vicinity of these locations.

7. DATA USABILITY

Groundwater, field blank, trip blank, and field duplicate samples were reported in Contract Laboratory Program (CLP) Data Packages received from SGS Accutest Laboratories in Dayton, New Jersey and Pace Analytical Energy Services, LLC, in Pittsburgh, Pennsylvania. All samples were analyzed per the revised 2016 QAPP (Geosyntec, 2016a).

A Stage 2A validation was performed on 100% of the data. None of the data were rejected; however, qualifications were applied to some of the data based on the results of the associated quality control samples. The samples were assessed against the results from the associated method blanks, laboratory control samples, matrix spike/matrix spike duplicate samples, laboratory duplicates, surrogate recoveries, serial dilutions, and post digestion spikes as applicable to the analysis. Analyte qualifications are listed in **Appendix C** by sample delivery group (SDG) and analytical test.

8. CONCLUSIONS

The 2016 OU3 MNA remedy monitoring findings are as follows:

- The hydraulic gradient in the shallow aquifer at the Site is fairly flat with little variation in groundwater elevation between wells;
- Off-Site pumping stresses result in variability in the hydraulic gradient (both in direction and magnitude) in the vicinity of the Site resulting in distinct shallow aquifer groundwater flow patterns;
- The shallow aquifer groundwater flow patterns observed in 2016 are consistent with those observed historically, with the predominant shallow groundwater flow direction being onto the Site from the northeast and/or south, and the predominant groundwater flow direction off the Site being generally to the west with some variability to the north and southwest;
- Due to the stability of the shallow aquifer groundwater flow patterns, the predominant flow pattern in the shallow aquifer can be established based on one week of transducer data;
- PCE, TCE, and VC continue to be detected in the shallow aquifer in the vicinity of the Site at concentrations above the ROD performance standards, while cDCE continues to be detected below the ROD performance standard;
- Shallow aquifer monitoring wells located hydraulically upgradient of the Site, in particular MW-10S and GM-05S, continue to exhibit higher PCE, TCE, and cDCE concentrations relative to shallow aquifer monitoring wells located on-Site and proximally downgradient of the Site. The observed groundwater flow patterns and current contaminant distribution indicates that upgradient off-Site sources of PCE and TCE are impacting Site groundwater;
- Shallow aquifer geochemical conditions in the vicinity of the Site continue to be conducive to the reductive dechlorination of chlorinated ethenes. The presence of VC in wells on-Site and proximally downgradient of the Site indicates that reductive dechlorination is actively occurring in the vicinity of the Site;
- The potential for on-Site VOC sources to impact shallow groundwater has been mitigated by the implementation of remedial actions, and off-Site upgradient sources are now the predominant sources of VOCs to shallow groundwater beneath the Site. The attenuation of on-Site shallow aquifer PCE and TCE concentrations to the ROD performance standards is unlikely to be achieved in the near future under these area-wide groundwater conditions; and
- Deep groundwater analytical results indicate that regional VOC impacts continue to affect the on- and off-Site deep aquifer wells.

9. RECOMMENDATIONS

9.1 Shallow Aquifer MNA Sampling Program

As presented in the OU3 100% Design (Geosyntec, 2013a), the MNA sampling program consists of quarterly sampling of the fourteen (14) shallow monitoring wells during the first two (2) years to assess seasonal effects and evaluate post-Cap conditions. The schedule anticipates semi-annual sampling through the fifth year of the MNA remedy and annual sampling thereafter, if necessary, to assess shallow groundwater contaminant attenuation.

2017 will be the first year of semi-annual shallow aquifer sampling events. In 2017, shallow aquifer sampling events are anticipated to be conducted in April and October. In a change from previous events, programmable pressure transducers will be used to collect instantaneous groundwater elevation measurements continuously at each of the fourteen (14) Site-associated shallow wells for one week instead of one month preceding each shallow aquifer sampling event. Geosyntec recommends no other changes to the MNA groundwater sampling program at this time.

As discussed above, the attenuation of on-Site shallow aquifer PCE and TCE concentrations to the ROD performance standards is unlikely to be achieved in the near future given the persistence of upgradient off-Site sources. Therefore, it is expected that the Committee will propose to modify the performance standards following the process described in the Statement of Work (USEPA, 2011a).

9.2 Deep Aquifer Monitoring Program

Deep aquifer monitoring wells will continue to be sampled on an annual basis. Deep aquifer sampling events are anticipated to be conducted in October of each year. As was the case in 2016, the deep aquifer will be monitored using PDBs. Geosyntec recommends no other changes to the deep aquifer groundwater sampling program at this time.

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TABLES

Geosyntec Consultants

Table 1: Groundwater Quality Parameters Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Well ID	GM-01S								GM-02S							
Sample Date	3/10/2015	6/10/2015	10/6/2015	12/3/2015	3/23/2016	8/11/2016	10/19/2016	11/29/2016	3/12/2015	6/10/2015	10/8/2015	12/3/2015	3/24/2016	8/9/2016	10/18/2016	11/30/2016
Field Sample ID	GM-01S.20150310	GM-1S.20150610	GM-01S.20151006	GM-01S.20151203	GM-01S.20160323	GM-01S.20160811	GM-01S.20161019	GM-01S.20161129	GM-2S.20150312	GM-2S.20150610	GM-02S.20151008	GM-02S.20151203	GM-02S.20160324	GM-02S.20160809	GM-02S.20161018	GM-02S.20161130
Field Parameters																
Temperature (C)	13.64	14.97	14.73	14.15	14.06	15.66	15.66	14.31	14.73	17.67	16.87	15.77	15.89	18.47	16.72	16.30
pH	5.04	5.07	5.00	5.04	5.14	4.88	5.12	5.10	6.23	5.88	5.60	5.83	5.12	5.64	5.38	5.75
Specific Conductance (uS/cm)	79	119	106	70	80	85	91	71	1,527	421	270	222	414	290	313	240
Dissolved Oxygen (mg/L)	0.65	0.74	0.38	1.48	0.79	0.45	0.48	0.89	2.03	0.92	0.68	0.89	0.80	0.56	0.56	0.35
Oxidation/Reduction Potential (mV)	300.9	377.9	269.4	272.4	241.1	341.6	326.1	206.5	99.2	160.9	208.6	266.2	95.2	258.6	241.5	160.4
Turbidity (NTU)	0.50	0.31	0.35	0.13	0.36	0.19	1.92	0.14	12.40	0.98	0.19	0.85	0.37	1.21	0.63	8.38

Well ID	GM-03RS								GM-05S							
Sample Date	3/11/2015	6/9/2015	10/6/2015	11/30/2015	3/24/2016	8/9/2016	10/20/2016	11/29/2016	3/10/2015	6/10/2015	10/8/2015	12/1/2015	3/24/2016	8/9/2016	10/18/2016	11/30/2016
Field Sample ID	GM-3RS.20150311	GM-3RS.20150609	GM-3RS.20151006	GM-03RS.20151130	GM-03RS.20160324	GM-03RS.20160809	GM-03RS.20161020	GM-03RS.20161129	GM-5S.20150310	GM-5S.20150610	GM05S.20151008	GM-05S.20151201	GM-05S.20160324	GM-05S.20150809	GM-05S.20161018	GM-05S.20161130
Field Parameters																
Temperature (C)	13.95	16.50	15.92	13.71	14.65	25.22	15.58	14.42	14.38	16.02	15.75	14.96	15.03	15.84	15.81	15.32
pH	5.22	5.13	4.96	4.94	4.93	4.55	7.69*	5.11	5.80	5.10	4.92	5.36	5.30	2.89*	5.09	5.32
Specific Conductance (uS/cm)	120	115	72	92	70	110	106	68	187	114	113	60	137	147	165	149
Dissolved Oxygen (mg/L)	1.04	0.72	0.75	0.82	1.06	2.00	2.20	0.43	3.55	4.38	4.30	3.20	3.09	3.87	2.48	1.37
Oxidation/Reduction Potential (mV)	169.6	218.9	193.5	146.8	56.0	702.8	252.7	269.1	196.9	240.8	237.0	282.6	87.8	690.9*	280.0	145.3
Turbidity (NTU)	0.42	0.97	1.67	1.75	1.15	2.17	1.62	1.81	11.50	0.57	0.42	0.00	0.40	0.11	0.12	0.30

Well ID	GM-06S								GM-07S							
Sample Date	3/10/2015	6/10/2015	10/8/2015	12/1/2015	3/24/2016	8/6/2016	10/18/2016	11/30/2016	3/11/2015	6/9/2015	10/7/2015	12/2/2015	3/24/2016	8/10/2016	10/20/2016	12/1/2016
Field Sample ID	GM-6S.20150310	GM-6S.20150610	GM-06S.20151008	GM-06S.20151201	GM-06S.20160324	GM-06S.20160809	GM-06S.20161018	GM-06S.20161130	GM-7S.20150311	GM-7S.20150609	GM-7S.20151007	GM-7S.20151202	GM-07S.20160324	GM-07S.20160810	GM-07S.20161020	GM-07S.20161201
Field Parameters																
Temperature (C)	14.18	15.51	14.99	14.66	14.80	16.95	15.36	14.82	13.54	15.14	14.45	13.69	14.23	15.62	14.40	14.07
pH	5.59	5.52	5.66	5.41	5.36	5.53	5.59	5.58	4.54	4.78	4.36	4.55	3.50	3.77	4.36	4.41
Specific Conductance (uS/cm)	226	222	215	224	209	163	293	234	337	369	433	357	378	537	522	168
Dissolved Oxygen (mg/L)	0.70	0.72	0.41	0.50	0.52	0.59	0.38	0.53	2.50	1.80	3.95	1.44	2.42	2.65	2.36	2.33
Oxidation/Reduction Potential (mV)	200.5	188.2	207.8	227.0	487.2*	263.4	268.1	232.9	317.2	217.0	264.1	357.4	128.0	273.8	422.1	333.5
Turbidity (NTU)	0.58	0.69	0.47	0.73	0.42	0.44	1.24	0.69	2.97	0.82	5.57	5.90	3.80	6.21	2.87	3.23

Notes:

*Value is out of range compared to the 2015-2016 dataset for this well and is considered an erroneous reading.

Table 1: Groundwater Quality Parameters Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Well ID	GM-08S								MW-01							
Sample Date	3/11/2015	6/9/2015	10/7/2015	12/2/2015	3/24/2016	8/10/2016	10/20/2016	12/1/2016	3/10/2015	6/10/2015	10/6/2015	12/2/2015	3/23/2016	8/10/2016	10/19/2016	11/29/2016
Field Sample ID	GM-8S.20150311	GM-8S.20150609	GM-08S.20151007	GM-08S.20151202	GM-08S.20160324	GM-08S.20160810	GM-08S.20161020	GM-08S.20161201	MW-1.20150310	MW-1.20150610	MW-1.20151006	MW-1.20151203	MW-01.20160323	MW-01.20160810	MW-01.20161019	MW-01.20161129
Field Parameters																
Temperature (C)	13.90	16.05	15.10	14.57	14.60	15.85	15.10	14.74	13.68	15.98	14.88	13.77	14.49	17.59	15.11	14.43
pH	6.29	6.30	6.41	6.06	5.74	5.20	5.95	5.87	5.71	5.62	5.66	5.75	5.42	4.68	5.46	5.15
Specific Conductance (uS/cm)	116	148	87	79	100	96	132	82	160	145	152	110	119	171	127	197
Dissolved Oxygen (mg/L)	2.54	1.16	1.01	1.00	0.87	0.71	0.60	1.17	1.45	1.51	0.55	2.18	1.06	0.64	0.73	0.41
Oxidation/Reduction Potential (mV)	-13.5	96.1	30.5	39.5	15.6	478.7	5.8	10.5	223.8	293.8	266.6	204.6	446.2	574.0	375.1	215.2
Turbidity (NTU)	29.70	14.00	8.52	9.69	5.92	6.38	0.00	5.23	0.41	0.24	0.15	0.14	0.58	0.38	0.54	0.35

Well ID	MW-02								MW-04							
Sample Date	3/12/2015	6/10/2015	10/7/2015	12/2/2015	3/23/2016	8/10/2016	10/19/2016	11/29/2016	3/10/2015	6/10/2015	10/6/2015	12/2/2015	3/23/2016	8/9/2016	10/19/2016	11/29/2016
Field Sample ID	MW-2.20150312	MW-2.20150610	MW-02.20151007	MW2.20151203	MW-02.20160323	MW-02.200160810	MW-02.20161019	MW-02.20161129	MW-4.20150310	MW-4.20150610	MW-4.20151006	MW4.20151202	MW-04.20160323	MW-04.2016	MW-04.20161019	MW-04.20161129
Field Parameters																
Temperature (C)	12.98	16.28	15.50	13.27	17.38	17.75	15.20	14.56	14.02	16.94	15.86	14.48	16.63	16.57	15.57	14.91
pH	5.36	5.38	5.36	5.35	4.73	5.29	4.34	4.88	5.43	4.11	5.09	5.37	4.78	4.89	5.00	5.23
Specific Conductance (uS/cm)	175	187	182	194	275	281	198	288	136	94	113	95	121	91	77	79
Dissolved Oxygen (mg/L)	1.81	2.66	0.60	0.72	0.56	0.41	0.42	0.11	3.59	5.47	3.99	5.11	6.06	5.88	5.79	6.60
Oxidation/Reduction Potential (mV)	97.7	314.7	220.0	191.0	-126.4	182.3	250.3	109.8	266.9	302.2	300.9	285.4	635.8	279.6	412.3	304.8
Turbidity (NTU)	18.00	9.06	1.17	0.74	0.68	0.22	2.07	2.43	1.97	1.61	2.20	0.23	1.66	0.28	1.03	1.67

Well ID	MW-07								MW-09S							
Sample Date	3/11/2015	6/10/2015	10/6/2015	12/1/2015	3/23/2016	8/10/2016	10/19/2016	11/30/2016	3/10/2015	6/9/2015	10/5/2015	12/2/2015	3/22/2016	8/11/2016	10/18/2016	11/30/2016
Field Sample ID	MW-7.20150311	MW-7.20150610	MW-07.20151006	MW-7.20151201	MW-07.20160323	MW-07.20160810	MW-07.20161019	MW-07.20161130	MW-9S.20150310	MW-9S.20150609	MW-09S.20151005	MW-09S.20151202	MW-09S.20160322	MW-09S.20160811	MW-09S.20161018	MW-09S.20161130
Field Parameters																
Temperature (C)	13.72	15.41	14.64	14.51	14.44	16.20	14.96	14.64	13.59	16.38	14.93	14.29	14.34	17.29	16.16	14.76
pH	6.21	3.99	5.01	5.04	4.70	3.11	6.24	4.93	6.40	5.97	7.22	6.32	6.05	3.94	5.69	5.58
Specific Conductance (uS/cm)	31	123	130	44	116	123	79	97	411	343	317	144	212	295	201	160
Dissolved Oxygen (mg/L)	8.94	7.37	5.51	7.50	4.95	6.67	7.94	7.40	0.69	0.89	0.64	0.91	1.22	0.79	1.02	0.72
Oxidation/Reduction Potential (mV)	191.4	342.9	231.9	137.6	204.3	679.8*	324.1	306.4	-63.2	-30.2	13.6	-44.7	42.3	581.0*	159.9	84.0
Turbidity (NTU)	17.50	1.31	1.65	1.22	0.88	1.54	3.82	0.83	6.09	19.90	7.54	8.61	7.14	2.84	6.34	7.63

Notes:

*Value is out of range compared to the 2015-2016 dataset for this well and is considered an erroneous reading.

Table 1: Groundwater Quality Parameters Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Well ID	MW-10S							
Sample Date	3/11/2015	6/9/2015	10/7/2015	12/2/2015	3/23/2016	8/10/2016	10/19/2016	12/1/2016
Field Sample ID	MW-10S.20150311	MW-10S.20150609	MW-10S.20151007	MW-10S.20151202	MW-10S.20160323	MW-105.20160810	MW-10S.20161019	MW-10S.20161201
Field Parameters								
Temperature (C)	13.56	15.51	14.20	13.67	14.14	15.12	14.15	13.69
pH	4.35	4.60	4.71	4.79	4.29	4.36	4.70	4.53
Specific Conductance (uS/cm)	404	254	444	108	132	552	163	173
Dissolved Oxygen (mg/L)	6.45	4.91	6.51	2.00	2.04	7.13	3.82	2.42
Oxidation/Reduction Potential (mV)	372.0	422.9	242.2	241.7	206.6	382.0	405.5	264.4
Turbidity (NTU)	0.56	0.31	0.26	0.23	0.14	0.36	0.87	0.46

Well ID	MW-11S							
Sample Date	3/11/2015	6/9/2015	10/8/2015	12/2/2015	3/22/2016	8/11/2016	10/18/2016	11/30/2016
Field Sample ID	MW-11S.20150311	MW-11S.20150609	MW-11S.20151008	MW-11S.20151202	MW-11S.20160322	MW-11S.20160811	MW-11S.20161018	MW-11S.20161130
Field Parameters								
Temperature (C)	15.05	17.77	17.11	15.33	15.28	17.83	17.15	15.51
pH	5.34	4.82	5.17	5.16	5.35	5.21	4.81	4.89
Specific Conductance (uS/cm)	76	72	58	38	55	64	89	117
Dissolved Oxygen (mg/L)	8.46	7.27	6.71	7.49	6.64	7.17	7.12	7.00
Oxidation/Reduction Potential (mV)	267.8	307.8	283.4	297.1	288.3	303.0	347.3	195.6
Turbidity (NTU)	4.22	2.75	4.07	18.40	1.07	0.76	0.15	0.64

Notes:

*Value is out of range compared to the 2015-2016 dataset for this well and is considered an erroneous reading.

Table 2: Shallow Aquifer Groundwater Elevation Data
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Well ID	Well Diameter (in.)	Total Depth of Well (ft. bgs)	Screened Interval (ft. bgs)	Depth to Water Measuring Point Elevation (ft. MSL)	Quarter 1			Quarter 2			Quarter 3			Quarter 4		
					Date	Depth to Water (ft. btoic)	Potentiometric Surface Elevation (ft. MSL)	Date	Depth to Water (ft. btoic)	Potentiometric Surface Elevation (ft. MSL)	Date	Depth to Water (ft. btoic)	Potentiometric Surface Elevation (ft. MSL)	Date	Depth to Water (ft. btoic)	Potentiometric Surface Elevation (ft. MSL)
GM-01S	4	130	110-130	66.49	3/21/2016	72.84	-6.35	8/8/2016	73.28	-6.79	10/17/2016	72.70	-6.21	11/28/2016	72.61	-6.12
GM-02S	4	130	110-130	59.44	3/21/2016	65.64	-6.20	8/8/2016	66.09	-6.65	10/17/2016	65.42	-5.98	11/28/2016	65.52	-6.08
GM-03RS	4	130	110-130	69.46	3/21/2016	75.82	-6.36	8/8/2016	76.24	-6.78	10/17/2016	75.64	-6.18	11/28/2016	75.61	-6.15
GM-05S	4	127	107-127	51.51	3/21/2016	57.73	-6.22	8/8/2016	58.09	-6.58	10/17/2016	57.51	-6.00	11/28/2016	57.55	-6.04
GM-06S	4	130	110-130	60.19	3/21/2016	66.46	-6.27	8/8/2016	67.00	-6.81	10/17/2016	66.31	-6.12	11/28/2016	66.44	-6.25
GM-07S	4	130	110-130	65.37	3/21/2016	71.79	-6.42	8/8/2016	72.19	-6.82	10/17/2016	71.65	-6.28	11/28/2016	71.60	-6.23
GM-08S	4	130	110-130	69.67	3/21/2016	76.21	-6.54	8/8/2016	76.64	-6.97	10/17/2016	76.10	-6.43	11/28/2016	76.10	-6.43
MW-01	4	130	110-130	68.64	3/21/2016	74.98	-6.35	8/8/2016	75.42	-6.79	10/17/2016	74.78	-6.15	11/28/2016	74.78	-6.15
MW-02	4	102	77-102	69.02	3/21/2016	75.34	-6.32	8/8/2016	75.79	-6.77	10/17/2016	75.20	-6.18	11/28/2016	75.18	-6.16
MW-04	4	130	110-130	63.30	3/21/2016	69.63	-6.33	8/8/2016	70.08	-6.78	10/17/2016	69.45	-6.15	11/28/2016	69.41	-6.11
MW-07	4	115	95-115	69.77	3/21/2016	76.13	-6.36	8/8/2016	76.64	-6.87	10/17/2016	75.94	-6.17	11/28/2016	76.09	-6.32
MW-09S	4	130	120-130	69.57	3/21/2016	75.95	-6.38	8/8/2016	76.46	-6.89	10/17/2016	75.84	-6.27	11/28/2016	75.90	-6.33
MW-10S	4	133	123-133	70.81	3/21/2016	77.21	-6.40	8/8/2016	77.60	-6.79	10/17/2016	77.02	-6.21	11/28/2016	77.00	-6.19
MW-11S	4	127	117-127	69.56	3/21/2016	76.07	-6.51	8/8/2016	76.54	-6.98	10/17/2016	75.82	-6.26	11/28/2016	75.87	-6.31

Notes:
ft. - Feet
in. - Inches
bgs - Below ground surface
MSL - Mean sea level
btoic - Below top of inner casing
Negative elevation values indicate values below mean sea level

Well ID	Well Diameter (in.)	Total Depth of Well (ft. bgs)	Screened Interval (ft. bgs)	Depth to Water Measuring Point Elevation (ft. MSL)	Date	Depth to Water (ft. BTOIC)	Potentiometric Surface Elevation (ft. MSL)
GM-01D	4	195	175-195	66.44	10/17/2016	73.03	-6.59
GM-02D	4	197	177-197	59.38	10/17/2016	65.72	-6.34
GM-03D	4	195	175-195	65.30	10/17/2016	72.19	-6.89
GM-04D	4	190	170-190	63.86	10/17/2016	70.59	-6.73
GM-05D	4	195	175-195	52.00	10/17/2016	58.39	-6.39
GM-06D	4	200	180-200	59.81	10/17/2016	66.33	-6.52
GM-07D	4	200	180-200	64.95	10/17/2016	72.11	-7.16
GM-08D	4	205	185-205	68.66	10/17/2016	76.03	-7.37

Notes:
ft. - Feet
in. - Inches
bgs - Below ground surface
MSL - Mean sea level
BTOIC - Below top of inner casing
Negative elevation values indicate values below mean sea level

Station Name	Units	CAS Number	ROD Performance Standards	GM-01S								GM-02S							
Sample Date				3/10/2015	6/10/2015	10/6/2015	12/3/2015	3/23/2016	8/11/2016	10/19/2016	11/29/2016	3/12/2015	6/10/2015	10/8/2015	12/3/2015	3/24/2016	8/9/2016	10/18/2016	11/30/2016
Field Sample ID				GM-01S.20150310	GM-01S.20150610	GM-01S.20151006	GM-01S.20151203	GM-01S.20160323	GM-01S.20160811	GM-01S.20161019	GM-01S.20161129	GM-02S.20150312	GM-02S.20150610	GM-02S.20151008	GM-02S.20151203	GM-02S.20160324	GM-02S.20160809	GM-02S.20161018	GM-02S.20161130
Sample Matrix				Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Dissolved Gases																			
Ethane	µg/L	74-84-0		0.002 U	0.002	0.0025 J	0.1 U	0.002 U	0.003 U	0.003 U	0.003 U	0.025	0.002 U	0.002 U	0.1 U	0.002 U	0.003 U	0.007 U	0.003 U
Ethene	µg/L	74-85-1		0.003 U	0.003	0.004 U	0.1 U	0.004 U	0.0035 J	0.29	0.001 U	0.026	0.003 U	0.004 U	0.1 U	0.004 U	0.001 U	0.009 U	0.001 U
Methane	µg/L	74-82-8		0.042 U	0.74 J	0.037 U	1.2	37	0.056 J	0.027 U	0.027 U	6.5	4.7	9.3	4.2	0.037 U	5.9 J	15	8
General Chemistry																			
Alkalinity, Total	µg/L	ALK		4,400	4,700	3,700	5000 U	7,000	3,200	7,200	5000 U	54,900	44,100	29,400	45,200	21,000	19,400	31,200	37,400
Nitrate	µg/L	14797-55-8		1,700	1,700	1,500	1,900	950	1,800	2,000	2,200	1,800	1,200	640	1,300	1,800	1,300	810	1,100
Nitrate and Nitrite	µg/L	OER-100-51		1,700	1,700	1,500	1,900	960	1,800	2,000	2,200	1,800	1,200	640	1,300	1,800	1,300	810	1,100
Nitrite	µg/L	14797-65-0		10 U	3.7	10 U	10 U	5.5	10 U	10 U	10 U	10 U	10 U	10 U	10 U	13	10 U	10 U	10 U
Sulfate	µg/L	14808-79-8		10,800	11,800	7,900	8,000	10,800	7,500	10000 U	10000 U	32,000	29,300	31,500	30,000	26,300	37,000	37,700	36,900
Total Organic Carbon	µg/L			940	930	450	1000 U	1000 U	1000 U	1000 U	1000 U	1,900	1,400	1,100	1000 U	1,100	900	1,100	1,200
Total Suspended Solids	mg/l	TSS		4 U	4	4 U	4 U	4 U	4 U	4 U	0.6	10	8	4 U	1.4	4 U	4 U	4 U	4.9
Metals																			
Iron (Dissolved)	µg/L	7439-89-6		6.1	4	6.6	50 U	13.5	50 U	50 U	50 U	140	20.6	50 U	50 U	50 U	50 U	50 U	50 U
Iron (Total)	µg/L	7439-89-6		12.3	5	10.1	50 U	16.9	50 U	50 U	50 U	908	29.5	50 U	50 U	9.6	50 U	50 U	503
Manganese (Dissolved)	µg/L	7439-96-5		96.4	132	139	128	122	100	109	114	208	223	644	655	327	574	1,050	855
Manganese (Total)	µg/L	7439-96-5		95.8	133	151	125	122	101	109	120	204	215	660	624	334	540	1,080	860
VOCs																			
1,1,1-Trichloroethane	µg/L	71-55-6	30	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	79-34-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	79-00-5	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane (Freon 113)	µg/L	76-13-1	20000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethane	µg/L	75-34-3	50	0.45 J	0.51 J	0.38 J	0.26 J	0.3 J	0.36 J	0.34 J	0.34 J	2	2.4	4.4	3	2.9	4.5	5.7	6.4
1,1-Dichloroethene	µg/L	75-35-4	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.19 J	0.24 J	1 U	1 U	0.23 J	1 U	0.28 J
1,2,4-Trichlorobenzene	µg/L	120-82-1	9	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.24 J	2 U	2 U	0.23 J	0.3 J
1,2-Dibromo-3-chloropropane	µg/L	96-12-8	0.02	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***
1,2-Dibromoethane	µg/L	106-93-4	0.03	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***
1,2-Dichlorobenzene	µg/L	95-50-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.23 J	0.28 J
1,2-Dichloroethane	µg/L	107-06-2	2	1 U	0.21 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.34 J	1 U	0.25 J	0.36 J	1 U	0.5 J
1,2-Dichloropropane	µg/L	78-87-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.87 J	1.1	1.7	1.2	1	1.5	1.9	2
1,3-Dichlorobenzene	µg/L	541-73-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	106-46-7	75	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.2 J	0.24 J
1,4-Dioxane	µg/L	123-91-1		-	-	0.14 J	0.276	0.11 U	0.1 U	0.177	0.181	-	-	0.55	0.625	0.369	0.502	0.743	0.914
2-Hexanone	µg/L	591-78-6	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	µg/L	67-64-1	6000	5 U	2.6 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	µg/L	71-43-2	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.18 J	1 U	1 U	0.16 J	1 U	0.49 J
Bromoform	µg/L	75-25-2	4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	74-83-9	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	75-15-0	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	56-23-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	108-90-7	50	1 U	0.26 J	1 U	1 U	1 U	1 U	1 U	1 U	0.25 J	0.32 J	0.44 J	0.3 J	1 U	0.42 J	0.57 J	0.71 J
Chloroethane	µg/L	75-00-3	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	67-66-3	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	µg/L	156-59-2	70	0.7 J	1.3	0.96 J	0.81 J	0.99 J	1.1	0.97 J	0.95 J	5.9	7.8	12.4	9	8.9	13.1	19	20.8
Dibromochloromethane	µg/L	124-48-1	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	75-71-8	1000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Ethylbenzene	µg/L	100-41-4	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	98-82-8	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl acetate	µg/L	79-20-9	7000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl ethyl ketone (2-Butanone)	µg/L	78-93-3	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl tert butyl ether	µg/L	1634-04-4	70	2.1	5.6	1.9	1.7	1.3	1.4	1.1	1.5	18.5	29.4	42.6	26.8	20.4	26.7	31.1	45.2
Methylene chloride	µg/L	75-09-2	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	100-42-5	100	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Tetrachloroethene	µg/L	127-18-4	1	0.96 J	1.2	1.3	1.2	0.97 J	1.2	1.2	1.3 J	2	1.7	1.9	2.1	1.7	2.7	3.4	3.6
Toluene	µg/L	108-88-3	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	156-60-5	100	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	79-01-6	1	3.2	2	2.1	2.1	2.8	3.2	3	2.8 J	3.5	3.4	4.6	3.8	3.1	5.5	7.7	7.5
Trichlorofluoromethane	µg/L	75-69-4	2000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	µg/L	75-01-4	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.33 J	0.5 J	0.86 J	0.45 J	0.34 J	0.53 J	0.99 J	1.1
Xylene (Total)	µg/L	1330-20-7	1000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:

Concentrations which exceed the ROD Performance Standards are highlighted blue

For some parameters the laboratory reporting limit exceeds the ROD Performance Standard. In cases where the laboratory reporting limit exceeds the ROD Performance Standard, and the parameter was not detected at above the laboratory reporting limit, the value reported is the laboratory reporting limit and it is ***italicized and brown***

J - Estimated value

U - Not detected above the laboratory reporting limit

Table 4: Shallow Aquifer Analytical Data Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Station Name	Units	CAS Number	ROD Performance Standards	GM-03RS								GM-05S							
Sample Date				3/11/2015	6/9/2015	10/6/2015	11/30/2015	3/24/2016	8/9/2016	10/20/2016	11/29/2016	3/10/2015	6/10/2015	10/8/2015	12/1/2015	3/24/2016	8/9/2016	10/18/2016	11/30/2016
Field Sample ID				GM-03RS.20150311	GM-03RS.20150609	GM-03RS.20151006	GM-03RS.20151130	GM-03RS.20160324	GM-03RS.20160809	GM-03RS.20161020	GM-03RS.20161129	GM-05S.20150310	GM-05S.20150610	GM-05S.20151008	GM-05S.20151201	GM-05S.20160324	GM-05S.20160809	GM-05S.20161018	GM-05S.20161130
Sample Matrix				Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Dissolved Gases																			
Ethane	µg/L	74-84-0		0.002 U	0.002 U	0.019 J	0.1 U	0.002 U	0.003 U	0.003 J	0.003 U	0.002 U	0.002	0.002 U	0.1 U	0.002 U	0.003 U	0.007 U	0.003 U
Ethene	µg/L	74-85-1		0.033	0.003 U	0.004 U	0.1 U	0.004 U	0.001 U	0.001 J	0.001 U	0.003 U	0.003	0.004 U	0.1 U	0.004 U	0.001 U	0.009 U	0.001 U
Methane	µg/L	74-82-8		60	27	46	4.3	7.6	22 J	4.7	2.6	0.042 U	0.042	0.037 U	0.5 U	0.037 U	0.027 U	0.027 U	0.027 U
General Chemistry																			
Alkalinity, Total	µg/L	ALK		10,300	8,400	9,100	7,700	10,500	5000 U	5000 U	5000 U	25,500	3,200	3,700	10,200	13,100	5000 U	3,300	2,200
Nitrate	µg/L	14797-55-8		53	260	250	290	330	150	570	540	2,600	3,500	1,900 J	2,400	2,500	2,500	2,500	2,200
Nitrate and Nitrite	µg/L	OER-100-51		55	260	250	290	340	160	570	540	2,600	3,500	1,900 J	2,400	2,500	2,500	2,500	2,200
Nitrite	µg/L	14797-65-0		2.4	10 U	10 U	10 U	13	7.1	10 U	10 U	10 U	3.7	10 U	10 U	12	10 U	10 U	10 U
Sulfate	µg/L	14808-79-8		17,600	13,300	13,700	13,100	11,600	12,500	13,600	14,300	18,500	13,800	16,500	26,300	23,800	22,500	29,200	33,500
Total Organic Carbon	µg/L			1,400	1,200	710	1000 U	1000 U	400	1000 U	1000 U	4,500	900	1000 U	1000 U	1000 U	410	300	1000
Total Suspended Solids	mg/l	TSS		3	5	4 U	4 U	4 U	4 U	4 U	1	2	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Metals																			
Iron (Dissolved)	µg/L	7439-89-6		660	276	599	126	78.9	50 U	58	50 U	349	4.7	50 U	50 U	50 U	50 U	50 U	50 U
Iron (Total)	µg/L	7439-89-6		667	336	665	171	109	135	86.9	200	542	11.7	50 U	21.6	5	50 U	50 U	50 U
Manganese (Dissolved)	µg/L	7439-96-5		516	531	497	465	492	488	441	482	50.2	20.4	79.4	101	81.7	126	150	144
Manganese (Total)	µg/L	7439-96-5		493	509	491	468	496	523	470	457	50.2	21	77.1	95.3	81.9	128	146	125
VOCs																			
1,1,1-Trichloroethane	µg/L	71-55-6	30	1 U	0.2 J	0.21 J	0.23 J	0.26 J	0.38 J	0.33 J	1 U	0.27 J	0.19 J	0.21 J	0.22 J	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	79-34-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	79-00-5	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane (Freon 113)	µg/L	76-13-1	20000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethane	µg/L	75-34-3	50	5.6	4.4	3.7	3	2.8	3.2	2.5	2.7	0.79 J	0.71 J	2.8	2.8	2.8	2.9	2.7	3.1
1,1-Dichloroethene	µg/L	75-35-4	1	0.82 J	0.62 J	0.61 J	0.47 J	0.55 J	0.46 J	0.49 J	0.53 J	0.37 J	0.23 J	0.62 J	0.63 J	0.65 J	0.58 J	0.53 J	0.71 J
1,2,4-Trichlorobenzene	µg/L	120-82-1	9	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dibromo-3-chloropropane	µg/L	96-12-8	0.02	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***
1,2-Dibromoethane	µg/L	106-93-4	0.03	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***
1,2-Dichlorobenzene	µg/L	95-50-1	600	0.22 J	0.22 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	µg/L	107-06-2	2	4.5	3.7	3.7	2.8	2.7	3.7	2.4	2.5	1 U	1 U	1 U	0.29 J	1 U	1 U	1 U	1 U
1,2-Dichloropropane	µg/L	78-87-5	1	1 U	0.2 J	0.2 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.2	1.1	1	1	0.96 J	1.2
1,3-Dichlorobenzene	µg/L	541-73-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	106-46-7	75	0.49 J	0.39 J	0.37 J	0.29 J	1 U	1 U	0.34 J	0.3 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane	µg/L	123-91-1		-	-	2.7	2.8	3.22	4.51	2.56	2.45	-	-	0.35	0.34	0.329	0.43	0.38	0.548
2-Hexanone	µg/L	591-78-6	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	µg/L	67-64-1	6000	5 U	2.8 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.1 J	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	µg/L	71-43-2	1	0.22 J	1 U	1 U	1 U	1 U	1 U	1 U	0.37 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	µg/L	75-25-2	4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	74-83-9	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	75-15-0	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	56-23-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	108-90-7	50	0.81 J	0.76 J	0.69 J	0.28 J	1 U	1 U	0.22 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	µg/L	75-00-3	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	67-66-3	70	1 U	1 U	1 U	1 U	0.18 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	µg/L	156-59-2	70	22	20.1	15.5	14.4	14.3	14.7	13.9	14.2	1.2	1.7	6.9	7.8	8.6	7.7	7.2	9
Dibromochloromethane	µg/L	124-48-1	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	75-71-8	1000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Ethylbenzene	µg/L	100-41-4	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	98-82-8	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl acetate	µg/L	79-20-9	7000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl ethyl ketone (2-Butanone)	µg/L	78-93-3	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl tert butyl ether	µg/L	1634-04-4	70	3.5	2.8	2.8	2.7	2.7	2.8	2.2	2.8	0.82 J	0.45 J	0.54 J	2.7	2.5	4.2	3.4	7
Methylene chloride	µg/L	75-09-2	3	0.23 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	100-42-5	100	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Tetrachloroethene	µg/L	127-18-4	1	2.6	2.3	2.3	1.8	2	2.4	2.3	2.3	3.1	2.4	2.7	2.8	2.8	3.7	2.6	3
Toluene	µg/L	108-88-3	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	156-60-5	100	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	79-01-6	1	14.7	14.8	17.6	15.2	19.8	19.2	22.8	23.5	1.4	1.3	3.9	4.6	4.9	5.3	5	5.3
Trichlorofluoromethane	µg/L	75-69-4	2000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	µg/L	75-01-4	1	0.92 J	0.55 J	0.43 J	0.26 J	0.29 J	0.22 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene (Total)	µg/L	1330-20-7	1000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:

Concentrations which exceed the ROD Performance Standards are highlighted blue

For some parameters the laboratory reporting limit exceeds the ROD Performance Standard. In cases where the laboratory reporting limit exceeds the ROD Performance Standard, and the parameter was not detected at above the laboratory reporting limit, the value reported is the laboratory reporting limit and it is ***italicized and brown***

J - Estimated value

U - Not detected above the laboratory reporting limit

Table 4: Shallow Aquifer Analytical Data Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Station Name	Units	CAS Number	ROD Performance Standards	GM-06S									GM-07S								
Sample Date				3/10/2015	6/10/2015	10/8/2015	12/1/2015	3/24/2016	8/9/2016	8/9/2016	10/18/2016	11/30/2016	3/11/2015	6/9/2015	10/7/2015	10/7/2015	12/2/2015	3/24/2016	8/10/2016	10/20/2016	12/1/2016
Field Sample ID				GM-06S.20150310	GM-06S.20150610	GM-06S.20151008	GM-06S.20151201	GM-06S.20160324	DUP-01.20160809	GM-06S.20160809	GM-06S.20161018	GM-06S.20161130	GM-07S.20150311	GM-07S.20150609	DUP-01.20151007	GM-07S.20151007	GM-07S.20151202	GM-07S.20160324	GM-07S.20160810	GM-07S.20161020	GM-07S.20161201
Sample Matrix				Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Dissolved Gases																					
Ethane	µg/L	74-84-0		0.002 U	0.002 U	0.002 U	0.1 U	0.002 U	0.003 U	0.003 U	0.007 U	0.11	0.002 U	0.002 U	0.14 J	0.002	0.1 U	0.002 U	0.0072 J	0.003 J	0.003 U
Ethene	µg/L	74-85-1		0.003 U	0.003 U	0.004 U	0.1 U	0.004 U	0.001 U	0.001 U	0.009 U	0.001 U	0.003 U	0.003 U	0.004 U	0.004 U	0.017 J	0.004 U	0.018 J	0.001 J	0.001 U
Methane	µg/L	74-82-8		0.36	1.2	1.1	1.8	1.3	0.027 U	0.027 U	3.8	5	0.47	0.66	5.9	5.1	9.8	2.7	3	6.6	8.7
General Chemistry																					
Alkalinity, Total	µg/L	ALK		21,600	24,200	6,800	25,500	21,000	11,300	10,800	20,600	15,100	2,900	5000 U	5000 U	5000 U	5000 U	5000 U	5000 U	5000 U	5000 U
Nitrate	µg/L	14797-55-8		1,700	1,300	1000 J	1,500	1,600	2,800	2,700	840	700	610	760	600	580	1800 U	930	1,100	1,100	820
Nitrate and Nitrite	µg/L	OER-100-51		1,700	1,300	1000 J	1,500	1,600	2,800	2,700	840	700	610	760	600	580	1800 U	940	1,100	1,100	820
Nitrite	µg/L	14797-65-0		10 U	10 U	10 U	10 U	11	10 U	10 U	10 U	10 U	10 U	10 U	2 U	2 U	10 U	13	10 U	10 U	10 U
Sulfate	µg/L	14808-79-8		18,400	27,900	26,600	29,300	25,800	21,200	21,200	42,300	44,000	28,600	21,300	21,700	21,100	22,600	2,200	20,000	24,800	23,400
Total Organic Carbon	µg/L			1,100	980	1000 U	1000 U	1000	370	340	330	1000	1000	940	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	430
Total Suspended Solids	mg/l	TSS		4 U	2	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	2.4	1.8	2	2.3	1.2	4 U	0.6
Metals																					
Iron (Dissolved)	µg/L	7439-89-6		27.2	20.6	50 U	0.71	50 U	50 U	50 U	50 U	50 U	88.3	20.6	81	80.4	88.9	109	119	50 U	50 U
Iron (Total)	µg/L	7439-89-6		38.2	25.2	50 U	7.2	6.4	50 U	50 U	50 U	50 U	136	58.1	237	247	258	242	266	111	126
Manganese (Dissolved)	µg/L	7439-96-5		635	416	418	491	689	683	707	1,300	1,460	2,930	3,450	3,050	3,200	2,990	2,970	2,610	2,600	2,230
Manganese (Total)	µg/L	7439-96-5		641	405	404	500	682	769	768	1,360	1,430	2,980	3,380	3,080	3,320	2,970	3,040	2,680	2,430	2,210
VOCs																					
1,1,1-Trichloroethane	µg/L	71-55-6	30	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.27 J	0.18 J	0.086	0.16 J	0.21 J	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	79-34-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	79-00-5	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane (Freon 113)	µg/L	76-13-1	20000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethane	µg/L	75-34-3	50	0.56 J	0.64 J	1.1	1.1	1.3	1.3	1.3	2.7	3.4	1.6	1.2	1.6	1.6	1.7	1.1	0.94 J	0.99 J	0.89 J
1,1-Dichloroethene	µg/L	75-35-4	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.3 J	0.23 J	0.26 J	0.25 J	0.28 J	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	µg/L	120-82-1	9	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.28 J	0.36 J	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dibromo-3-chloropropane	µg/L	96-12-8	0.02	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***
1,2-Dibromoethane	µg/L	106-93-4	0.03	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***
1,2-Dichlorobenzene	µg/L	95-50-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	µg/L	107-06-2	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.6	3.1	2.8	2.8	2.9	2	1.2	1.4	1.5
1,2-Dichloropropane	µg/L	78-87-5	1	1 U	1 U	0.47 J	0.5 J	0.58 J	0.54 J	0.54 J	0.96 J	1.3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	µg/L	541-73-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	106-46-7	75	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane	µg/L	123-91-1		-	-	0.21	0.24	0.258	0.203	0.212	0.425	0.788	-	-	3.4	3.5	4.2	2.65	2.7	1.77	2.98
2-Hexanone	µg/L	591-78-6	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	µg/L	67-64-1	6000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4.1 J	2.4	21.4 J	5 U	5 U	5 U	5 U	5 U
Benzene	µg/L	71-43-2	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	µg/L	75-25-2	4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	74-83-9	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	75-15-0	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	56-23-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	108-90-7	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.38 J	0.49 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	µg/L	75-00-3	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.21	0.44 J	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	67-66-3	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	µg/L	156-59-2	70	0.65 J	1.3	1.9	2.2	3.5	2.5	2.5	7.4	9.5	12.2	11.9	11.2	11.4	13	9.3	6.8	6.9	7.6
Dibromochloromethane	µg/L	124-48-1	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	75-71-8	1000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Ethylbenzene	µg/L	100-41-4	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	98-82-8	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl acetate	µg/L	79-20-9	7000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl ethyl ketone (2-Butanone)	µg/L	78-93-3	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl tert butyl ether	µg/L	1634-04-4	70	4.3	6.6	7.6	11.2	10.7	2.2	2.2	23	30.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene chloride	µg/L	75-09-2	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	100-42-5	100	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Tetrachloroethene	µg/L	127-18-4	1	0.37 J	0.28 J	0.39 J	0.5 J	0.65 J	1.2 J	0.93 J	0.82 J	1.1	1.2	1.3	1.3	1.2	1.3	0.87 J	0.81 J	0.83 J	0.81 J
Toluene	µg/L	108-88-3	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	156-60-5	100	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	79-01-6	1	0.44 J	0.49 J	0.57 J	0.86 J	1.1	1.6	1.7	1.8	2.2	15.5	14.5	13	14	13.3	8.7	7.9	9.8	13.2
Trichlorofluoromethane	µg/L	75-69-4	2000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	µg/L	75-01-4	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.56 J	0.79 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene (Total)	µg/L	1330-20-7	1000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:

Concentrations which exceed the ROD Performance Standards are highlighted blue

For some parameters the laboratory reporting limit exceeds the ROD Performance Standard. In cases where the laboratory reporting limit exceeds the ROD Performance Standard, and the parameter was not detected at above the laboratory reporting limit, the value reported is the laboratory reporting limit and it is ***italicized and brown***

J - Estimated value

U - Not detected above the laboratory reporting limit

Table 4: Shallow Aquifer Analytical Data Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Station Name				GM-08S								MW-01							
Sample Date	Units	CAS Number	ROD Performance Standards	3/11/2015	6/9/2015	10/7/2015	12/2/2015	3/24/2016	8/10/2016	10/20/2016	12/1/2016	3/10/2015	6/10/2015	10/6/2015	12/3/2015	3/23/2016	8/10/2016	10/19/2016	11/29/2016
Field Sample ID				GM-08S.20150311	GM-08S.20150609	GM-08S.20151007	GW-08S.20151202	GM-08S.20160324	GM-08S.20160810	GM-08S.20161020	GM-08S.20161201	MW-01.20150310	MW-01.20150610	MW-01.20151006	MW-01.20151203	MW-01.20160323	MW-01.20160810	MW-01.20161019	MW-01.20161129
Sample Matrix				Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Dissolved Gases																			
Ethane	µg/L	74-84-0		0.002 U	0.002 U	0.002 U	0.1 U	0.002 U	0.003 U	0.003 J	0.003 U	0.002 U	0.002 U	0.014 J	0.1 U	0.002 U	0.003 U	0.003 J	0.003 U
Ethene	µg/L	74-85-1		0.003 U	0.003 U	0.004 U	0.13	0.004 U	0.001 U	0.47	0.62	0.003 U	0.003 U	0.004 U	0.1 U	0.004 U	0.001 U	0.001 J	0.001 U
Methane	µg/L	74-82-8		2	2.2	3.9	30	31	10	43	55	7.3	20	14	11	11	16	8.6	5.3
General Chemistry																			
Alkalinity, Total	µg/L	ALK		33,300	34,700	24,200	10,200	22,100	15,100	24,500	13,900	29,400	26,300	32,100	34,700	26,000	30,200	29,000	21,700
Nitrate	µg/L	14797-55-8		120	48	32	1500 U	110 U	68	330	110 U	360	850	430	530	540	830	1000	1,100
Nitrate and Nitrite	µg/L	OER-100-51		120	48	32	1500 U	100 U	68	330	100 U	360	860	430	530	540	830	1000	1,100
Nitrite	µg/L	14797-65-0		10 U	10 U	2 U	10 U	12	10 U	10 U	10 U	2.4	5.1	10 U	10 U	10 U	10 U	10 U	10 U
Sulfate	µg/L	14808-79-8		15,800	11,700	10,100	13,200	11,300	9,400	16,000	18,300	11,500	15,200	11,600	12,400	13,400	14,600	18,000	16,500
Total Organic Carbon	µg/L			830	770	1000 U	1000 U	1000 U	1000 U	1000 U	510	920	900	590	1000 U	1000 U	1000 U	1000 U	1000 U
Total Suspended Solids	mg/l	TSS		6	9	3.6	3.2	4 U	2	4 U	1.8	2	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Metals																			
Iron (Dissolved)	µg/L	7439-89-6		3,040	590	4,110	5,230	8,880	5,920	12,600	12,100	8	2.7	2.2	50 U	4	50 U	50 U	50 U
Iron (Total)	µg/L	7439-89-6		4,900	1,350	4,410	5,350	8,620	5,900	12,700	12,000	6.4	2.3	5.3	64.3	4.3	50 U	50 U	50 U
Manganese (Dissolved)	µg/L	7439-96-5		411	506	463	566	707	544	671	787	600	424	574	471	418	368	326	318
Manganese (Total)	µg/L	7439-96-5		409	517	442	589	678	547	694	759	606	439	589	478	407	344	331	322
VOCs																			
1,1,1-Trichloroethane	µg/L	71-55-6	30	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.22 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	79-34-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	79-00-5	3	1 U	1 U	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane (Freon 113)	µg/L	76-13-1	20000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethane	µg/L	75-34-3	50	0.38 J	0.64 J	0.27 J	1.1	1.1	0.58 J	1.3	1.5	0.63 J	0.55 J	0.66 J	0.54 J	0.9 J	1	1.2	1.2
1,1-Dichloroethene	µg/L	75-35-4	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.32 J	0.26 J	0.37 J	0.24 J	0.25 J	0.41 J	0.29 J	0.36 J
1,2,4-Trichlorobenzene	µg/L	120-82-1	9	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dibromo-3-chloropropane	µg/L	96-12-8	0.02	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***
1,2-Dibromoethane	µg/L	106-93-4	0.03	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	1	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***
1,2-Dichlorobenzene	µg/L	95-50-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.19 J	1 U	1 U	0.2 J	1 U	1 U
1,2-Dichloroethane	µg/L	107-06-2	2	0.27 J	0.65 J	1 U	0.9 J	0.83 J	0.45 J	1.3	1.5	0.29 J	1 U	0.32 J	0.23 J	1 U	0.32 J	1 U	1 U
1,2-Dichloropropane	µg/L	78-87-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.23 J	1 U	0.26 J	1 U	0.35 J	0.34 J	1 U	0.54 J
1,3-Dichlorobenzene	µg/L	541-73-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	106-46-7	75	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.25 J	0.37 J	0.38 J	0.28 J	0.28 J	0.36 J	0.29 J	0.25 J
1,4-Dioxane	µg/L	123-91-1		-	-	0.71	2.9	3.82	2.44	3.48	4.74	-	-	0.71	0.972	1.17	1.36	0.864	0.968
2-Hexanone	µg/L	591-78-6	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	µg/L	67-64-1	6000	5 U	5 U	5 U	5 U	5 U	5 U	5	5 U	5 U	4.3 J	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	µg/L	71-43-2	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.22 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	µg/L	75-25-2	4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	74-83-9	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	75-15-0	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	56-23-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	108-90-7	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.41 J	0.56 J	0.53 J	0.46 J	0.53 J	0.68 J	0.52 J	0.5 J
Chloroethane	µg/L	75-00-3	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	67-66-3	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.2 J	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	µg/L	156-59-2	70	0.22 J	0.27 J	1 U	0.52 J	0.73 J	1	0.75 J	0.97 J	1.8	2	1.5	1.9	2.6	2.9	4.2	3.7
Dibromochloromethane	µg/L	124-48-1	1	1 U	1 U	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	75-71-8	1000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Ethylbenzene	µg/L	100-41-4	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	98-82-8	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl acetate	µg/L	79-20-9	7000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl ethyl ketone (2-Butanone)	µg/L	78-93-3	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl tert butyl ether	µg/L	1634-04-4	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	3.9	3.1	3.3	3.3	12.1	9.9	15.5	13.7
Methylene chloride	µg/L	75-09-2	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	100-42-5	100	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Tetrachloroethene	µg/L	127-18-4	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.6	1.7	1.7	1.7	1.7	1.6	1.7	1.6
Toluene	µg/L	108-88-3	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	156-60-5	100	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	79-01-6	1	0.43 J	0.37 J	0.29 J	0.6 J	0.61 J	0.5 J	1.1	1.3 J	1.1	1.6	2.3	2.1	2.1	3	3.5	3.4
Trichlorofluoromethane	µg/L	75-69-4	2000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	µg/L	75-01-4	1	1 U	1 U	1 U	0.3 J	1 U	1 U	0.74 J	0.84 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene (Total)	µg/L	1330-20-7	1000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:

Concentrations which exceed the ROD Performance Standards are highlighted blue

For some parameters the laboratory reporting limit exceeds the ROD Performance Standard. In cases where the laboratory reporting limit exceeds the ROD Performance Standard, and the parameter was not detected at above the laboratory reporting limit, the value reported is the laboratory reporting limit and it is ***italicized and brown***

J - Estimated value

U - Not detected above the laboratory reporting limit

Table 4: Shallow Aquifer Analytical Data Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Station Name	Units	CAS Number	ROD Performance Standards	MW-02								MW-04							
Sample Date				3/12/2015	6/10/2015	10/7/2015	12/3/2015	3/23/2016	8/10/2016	10/19/2016	11/29/2016	3/10/2015	6/10/2015	10/6/2015	12/2/2015	3/23/2016	8/9/2016	10/19/2016	11/29/2016
Field Sample ID				MW-02.20150312	MW-02.20150610	MW-02.20151007	MW-02.20151203	MW-02.20160323	MW-02.20160810	MW-02.20161019	MW-02.20161129	MW-04.20150310	MW-04.20150610	MW-04.20151006	MW-04.20151202	MW-04.20160323	MW-04.20160809	MW-04.20161019	MW-04.20161129
Sample Matrix				Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Dissolved Gases																			
Ethane	µg/L	74-84-0		0.002 U	0.002 U	0.002 U	0.1 U	0.002 U	0.003 U	0.003 U	0.16	0.002 U	0.002 U	0.0053 J	0.1 U	0.002 U	0.003 U	0.26	0.003 U
Ethene	µg/L	74-85-1		0.003 U	0.003 U	0.004 U	0.1 U	0.004 U	0.001 U	0.001 U	0.001 U	0.003 U	0.003 U	0.004 U	0.013 J	0.004 U	0.001 U	0.14	0.001 U
Methane	µg/L	74-82-8		1.1	0.042 U	1.7	1.6	200	240	290	230	0.95	0.042 U	0.037 U	0.5 U	0.037 U	0.027 U	1.4	0.027 U
General Chemistry																			
Alkalinity, Total	µg/L	ALK		23,000	24,200	25,700	19,100	22,500	9,700	29,000	7,800	21,100	4,700	8,600	1,500	10,000	3,800	7,200	5000 U
Nitrate	µg/L	14797-55-8		110 U	26	150 J	110 U	110 U	68	71	190	2,500	2,800	2,700	110 U	3,200	3,900	3,700	3,500
Nitrate and Nitrite	µg/L	OER-100-51		100 U	29	150 J	77	100 U	68	100 U	190	2,500	2,800	2,700	100 U	3,200	3,900	3,700	3,500
Nitrite	µg/L	14797-65-0		10 U	3.5	2 U	10 U	10 U	10 U	10 U	10 U	10 U	5.3	10 U	10 U	10 U	10 U	10 U	10 U
Sulfate	µg/L	14808-79-8		19,300	18,500	31,000	34,200	35,400	38,600	46,900	45,700	13,600	13,900	12,400	12,800	12,500	11,300	13,600	12,800
Total Organic Carbon	µg/L			1,800	1,300	1,300	1,100	1,400	1,200	790	1,600	960	1000	540	1000 U	1000 U	350	310	1000 U
Total Suspended Solids	mg/l	TSS		5	4 U	4 U	4 U	4 U	1	4 U	0.8	5	4 U	4 U	4 U	4 U	4 U	4 U	1.3
Metals																			
Iron (Dissolved)	µg/L	7439-89-6		18.6	27.6	631	162	2,280	4,240	3,940	2,850	4.9	3.9	10.1	50 U	50 U	50 U	50 U	50 U
Iron (Total)	µg/L	7439-89-6		1,800	984	582	128	2,230	4,270	3,820	3,010	3,880	54.6	63.6	50 U	50 U	50 U	50 U	50 U
Manganese (Dissolved)	µg/L	7439-96-5		747	675	759	697	787	1,170	1,260	1,190	36.1	76.7	41.4	50	51.9	60.8	58	66.3
Manganese (Total)	µg/L	7439-96-5		740	669	753	666	812	1,100	1,180	1,130	1,840	81	48.2	50.1	59.7	63	59.6	71.5
VOCs																			
1,1,1-Trichloroethane	µg/L	71-55-6	30	0.98 J	0.56 J	0.43 J	0.36 J	0.33 J	0.21 J	1 U	0.26 J	0.23 J	1 U	1 U	1 U	1 U	1 U	1 U	0.51 J
1,1,2,2-Tetrachloroethane	µg/L	79-34-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	79-00-5	3	0.76 J	0.69 J	0.82 J	0.8 J	0.84 J	0.85 J	0.84 J	0.97 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane (Freon 113)	µg/L	76-13-1	20000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethane	µg/L	75-34-3	50	7.3	5	5.5	4.3	4.5	4.4	3.6	3.9	0.24 J	0.17 J	1 U	1 U	0.26 J	0.23 J	1 U	0.49 J
1,1-Dichloroethene	µg/L	75-35-4	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	µg/L	120-82-1	9	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dibromo-3-chloropropane	µg/L	96-12-8	0.02	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***
1,2-Dibromoethane	µg/L	106-93-4	0.03	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***
1,2-Dichlorobenzene	µg/L	95-50-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	µg/L	107-06-2	2	9.5	8.7	9	8.5	7.5	7.4	7.1	7.3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	µg/L	78-87-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	µg/L	541-73-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	106-46-7	75	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane	µg/L	123-91-1		-	-	25.5	40	47.6	38.4	45.6	44.9	-	-	0.32	0.36	0.7	0.502	0.42	0.354
2-Hexanone	µg/L	591-78-6	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	µg/L	67-64-1	6000	4.1 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	µg/L	71-43-2	1	0.26 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	µg/L	75-25-2	4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	74-83-9	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	75-15-0	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	56-23-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	108-90-7	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	µg/L	75-00-3	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	67-66-3	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.15 J	0.18 J	0.22 J	0.22 J	0.21 J	1 U	1 U
cis-1,2-Dichloroethene	µg/L	156-59-2	70	11.9	9.2	9.9	8.7	9.1	10.8	9.8	11.3	8.5	7.4	8.5	10.2	10.5	9.2	11.3	13.5
Dibromochloromethane	µg/L	124-48-1	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	75-71-8	1000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Ethylbenzene	µg/L	100-41-4	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	98-82-8	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl acetate	µg/L	79-20-9	7000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl ethyl ketone (2-Butanone)	µg/L	78-93-3	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl tert butyl ether	µg/L	1634-04-4	70	0.68 J	0.46 J	0.41 J	0.42 J	0.38 J	0.23 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene chloride	µg/L	75-09-2	3	0.29 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	100-42-5	100	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Tetrachloroethene	µg/L	127-18-4	1	5.5	3.8	3.2	2.8	2.3	2.2	2	2.3	1.1	1.4	0.89 J	0.87 J	0.84 J	1.2	1.1	1.2
Toluene	µg/L	108-88-3	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	156-60-5	100	1 U	0.29 J	0.22 J	1 U	1 U	1 U	1 U	1 U	1 U	0.19 J	0.23 J	1 U	0.2 J	1 U	1 U	0.24 J
Trichloroethene	µg/L	79-01-6	1	13	9.7	12.2	10.1	9.6	10.6	10.5	13.2	45.7	39.8	43.8	44.3	48.2	54.1	56.1	62.1
Trichlorofluoromethane	µg/L	75-69-4	2000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	µg/L	75-01-4	1	1 U	1 U	1 U	1 U	1 U	0.47 J	1 U	0.44 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene (Total)	µg/L	1330-20-7	1000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:

Concentrations which exceed the ROD Performance Standards are highlighted blue

For some parameters the laboratory reporting limit exceeds the ROD Performance Standard. In cases where the laboratory reporting limit exceeds the ROD Performance Standard, and the parameter was not detected at above the laboratory reporting limit, the value reported is the laboratory reporting limit and it is ***italicized and brown***

J - Estimated value

U - Not detected above the laboratory reporting limit

Table 4: Shallow Aquifer Analytical Data Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Station Name	Units	CAS Number	ROD Performance Standards	MW-07									MW-09S							
Sample Date				3/11/2015	6/10/2015	10/6/2015	12/1/2015	12/1/2015	3/23/2016	8/10/2016	10/19/2016	11/30/2016	3/10/2015	6/9/2015	10/5/2015	12/2/2015	3/22/2016	8/11/2016	10/18/2016	11/30/2016
Field Sample ID				MW-07.20150311	MW-07.20150610	MW-07.20151006	DUP-01.20151201	MW-07.20151201	MW-07.20160323	MW-07.20160810	MW-07.20161019	MW-07.20161130	MW-09S.20150310	MW-09S.20150609	MW-09S.20151005	MW-09S.20151202	MW-09S.20160322	MW-09S.20160811	MW-09S.20161018	MW-09S.20161130
Sample Matrix				Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Dissolved Gases																				
Ethane	µg/L	74-84-0		0.002 U	0.002 U	0.0078 J	0.1 U	0.1 U	0.002 U	0.003 J	0.003 J	0.003 U	0.002 U	0.002 U	0.002 U	0.1 U	0.002 U	0.028 J	0.003 U	0.003 U
Ethene	µg/L	74-85-1		0.003 U	0.003 U	0.004 U	0.1 U	0.1 U	0.004 U	0.001 U	0.001 J	0.001 U	0.48	0.38	0.004 U	0.17	0.004 U	0.36	0.001 U	0.15
Methane	µg/L	74-82-8		0.042 U	0.042 U	0.037 U	0.5 U	0.5 U	8.8	0.027 U	0.027 J	0.027 U	94	64	38	32	38	100	24	14
General Chemistry																				
Alkalinity, Total	µg/L	ALK		6,900	5000 U	2,100	13000 U	13000 U	10000 U	5000 U	5000 U	5000 U	43,600	95,800	53,800	51,000	42,500	51,800	34,000	24,500
Nitrate	µg/L	14797-55-8		94	1,800	1,700	2,300	2,200	2,300	2,600	2,600	2,200	110 U	87	140	110 U	180	110 U	370	380
Nitrate and Nitrite	µg/L	OER-100-51		96	1,800	1,700	2,300	2,200	2,300	2,600	2,600	2,200	100 U	87	140	100 U	180	100 U	370	380
Nitrite	µg/L	14797-65-0		2.4	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Sulfate	µg/L	14808-79-8		1,700	4,800	2,700	2,700	2,800	1,600	2,000	10000 U	2,500	30,800	30,200	34,400	19,300	16,000	25,200	19,400	20,300
Total Organic Carbon	µg/L			3,800	740	520	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1,800	1,800	1,100	1,200	1000 U	1000 U	450	1000 U
Total Suspended Solids	mg/l	TSS		12	4 U	3.2	1.8 J	4	1.4	0.6	3.8	1	28	33	4.8	4.8	4.4	4 U	6.8	3.2
Metals																				
Iron (Dissolved)	µg/L	7439-89-6		29.6	2.4	1.8	50 U	50 U	50 U	3.8	50 U	5.2	48,700	31,800	25,800	17,500	14,300	27,400	12,100	7,510
Iron (Total)	µg/L	7439-89-6		469	35.8	86	25.7	29.4	27	31.8	59	16.4	46,900	29,800	25,100	15,300	14,300	27,700	12,500	7,500
Manganese (Dissolved)	µg/L	7439-96-5		2.9	47.8	48.5	43.1	41.5	53.4	51.2	52.2	65.1	366	425	515	305	233	570	249	290
Manganese (Total)	µg/L	7439-96-5		6.7	55.3	52.4	45.5	44.1	61.4	54.1	58.8	71	361	392	497	275	231	568	253	288
VOCs																				
1,1,1-Trichloroethane	µg/L	71-55-6	30	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	79-34-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	79-00-5	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.42 J	1 U	1 U	0.27 J	1 U	1 U
1,1,2-Trichlorotrifluoroethane (Freon 113)	µg/L	76-13-1	20000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethane	µg/L	75-34-3	50	1 U	0.31 J	0.38 J	0.3 J	0.33 J	0.28 J	0.3 J	0.28 J	0.23 J	4.6	2.2	2.8	1.3	1.2	3.8	1.5	1.5
1,1-Dichloroethene	µg/L	75-35-4	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.24 J	0.29 J	0.33 J	1 U	0.38 J
1,2,4-Trichlorobenzene	µg/L	120-82-1	9	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dibromo-3-chloropropane	µg/L	96-12-8	0.02	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***
1,2-Dibromoethane	µg/L	106-93-4	0.03	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***
1,2-Dichlorobenzene	µg/L	95-50-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.2 J	1 U	0.18 J	1 U	1 U
1,2-Dichloroethane	µg/L	107-06-2	2	1 U	1 U	0.22 J	0.31 J	0.3 J	1 U	1 U	1 U	0.23 J	10.7	5	5.7	1.8	0.9 J	4.8	1.4	1.1
1,2-Dichloropropane	µg/L	78-87-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	µg/L	541-73-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	106-46-7	75	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.37 J	0.4 J	0.4 J	0.33 J	0.28 J
1,4-Dioxane	µg/L	123-91-1		-	-	0.22 U	0.21 U	0.2 U	0.11 U	0.1 U	0.1 U	0.1 U	-	-	17.1	4.3	3.76 J	23.4	3.96	3.92
2-Hexanone	µg/L	591-78-6	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	µg/L	67-64-1	6000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	µg/L	71-43-2	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.18 J	1 U	0.66 J
Bromoform	µg/L	75-25-2	4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	74-83-9	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	75-15-0	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	56-23-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	108-90-7	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.69 J	0.71 J	0.67 J	0.63 J	0.66 J
Chloroethane	µg/L	75-00-3	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	67-66-3	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	µg/L	156-59-2	70	1 U	3.3	3.2	2.9	3	2.4	2.8	2.3	2	11.6	5.7	8.2	4.7	5.5	12.5	5.3	5.3
Dibromochloromethane	µg/L	124-48-1	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	75-71-8	1000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Ethylbenzene	µg/L	100-41-4	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	98-82-8	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl acetate	µg/L	79-20-9	7000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl ethyl ketone (2-Butanone)	µg/L	78-93-3	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl tert butyl ether	µg/L	1634-04-4	70	1 U	0.24 J	0.2 J	1 U	1 U	1 U	0.32 J	1 U	1 U	1.1	0.45 J	0.73 J	4.1	4.5	3	4.8	12
Methylene chloride	µg/L	75-09-2	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	100-42-5	100	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Tetrachloroethene	µg/L	127-18-4	1	1 U	0.7 J	0.57 J	0.64 J	0.61 J	0.52 J	0.56 J	0.39 J	0.61 J	3.4	1.1	3.6	1.4	1.6	2.2	1.5	1.5
Toluene	µg/L	108-88-3	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	156-60-5	100	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.23 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	79-01-6	1	0.2 J	5.4	4.5	4.5	4.5	3.5	3.7	3.6	3.5	10.4	2.8	6	4.4	5.9	9.4	4.9	5.3
Trichlorofluoromethane	µg/L	75-69-4	2000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	µg/L	75-01-4	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.8	1.3	1.6	0.58 J	0.34 J	1.8	1 U	0.33 J
Xylene (Total)	µg/L	1330-20-7	1000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:

Concentrations which exceed the ROD Performance Standards are highlighted blue

For some parameters the laboratory reporting limit exceeds the ROD Performance Standard. In cases where the laboratory reporting limit exceeds the ROD Performance Standard, and the parameter was not detected at above the laboratory reporting limit, the value reported is the laboratory reporting limit and it is ***italicized and brown***

J - Estimated value

U - Not detected above the laboratory reporting limit

Table 4: Shallow Aquifer Analytical Data Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Station Name	Units	CAS Number	ROD Performance Standards	MW-10S							
Sample Date				3/11/2015	6/9/2015	10/7/2015	12/2/2015	3/23/2016	8/10/2016	10/19/2016	12/1/2016
Field Sample ID				MW-10S.20150311	MW-10S.20150609	MW-10S.20151007	MW-10S.20151202	MW-10S.20160323	MW-10S.20160810	MW-10S.20161019	MW-10S.20161201
Sample Matrix				Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Dissolved Gases											
Ethane	µg/L	74-84-0		0.002 U	0.002 U	0.002 U	0.1 U	0.002 U	0.007 U	0.003 J	0.003 U
Ethene	µg/L	74-85-1		0.047	0.003 U	0.004 U	0.087 J	0.004 U	0.03 J	0.11	0.11
Methane	µg/L	74-82-8		0.23	0.042 U	1.6	0.5 U	0.037 U	0.027 U	0.027 J	0.027 U
General Chemistry											
Alkalinity, Total	µg/L	ALK		5000 U	5000 U	5000 U	5000 U	4,500	5000 U	5000 U	5000 U
Nitrate	µg/L	14797-55-8		1,800	1,500	1,100 J	110 U	1,600	1,300	1,800	1,900
Nitrate and Nitrite	µg/L	OER-100-51		1,800	1,500	1,100 J	100 U	1,600	1,300	1,800	1,900
Nitrite	µg/L	14797-65-0		10 U	10 U	2 U	10 U	10 U	10 U	10 U	10 U
Sulfate	µg/L	14808-79-8		24,800	18,300	18,900	21,900	17,700	18,500	25,100	21,200
Total Organic Carbon	µg/L			1000	900	1,100	1,100	1000 U	1000 U	1000 U	460
Total Suspended Solids	mg/l	TSS		4 U	4 U	1.2	4 U	4 U	4 U	4 U	4 U
Metals											
Iron (Dissolved)	µg/L	7439-89-6		50 U	7.2	50 U	50 U	50 U	50 U	50 U	50 U
Iron (Total)	µg/L	7439-89-6		50 U	2.8	50 U	50 U	50 U	50 U	50 U	50 U
Manganese (Dissolved)	µg/L	7439-96-5		443	322	540	234	260	540	267	228
Manganese (Total)	µg/L	7439-96-5		436	313	566	242	262	567	228	228
VOCs											
1,1,1-Trichloroethane	µg/L	71-55-6	30	0.31 J	0.39 J	0.29 J	0.5 J	0.62 J	1 U	0.77 J	0.59 J
1,1,2,2-Tetrachloroethane	µg/L	79-34-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	79-00-5	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane (Freon 113)	µg/L	76-13-1	20000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethane	µg/L	75-34-3	50	0.86 J	0.63 J	0.82 J	0.83 J	0.93 J	0.59 J	0.95 J	0.85 J
1,1-Dichloroethene	µg/L	75-35-4	1	0.44 J	0.59 J	0.53 J	0.84 J	1	0.4 J	1.4	1.4
1,2,4-Trichlorobenzene	µg/L	120-82-1	9	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dibromo-3-chloropropane	µg/L	96-12-8	0.02	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***
1,2-Dibromoethane	µg/L	106-93-4	0.03	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***
1,2-Dichlorobenzene	µg/L	95-50-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	µg/L	107-06-2	2	1.2	1.1	1.1	0.77 J	0.57 J	0.74 J	0.44 J	1 U
1,2-Dichloropropane	µg/L	78-87-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	µg/L	541-73-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	106-46-7	75	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane	µg/L	123-91-1		-	-	3.2	4	5.77	3.64	3.37	3.89
2-Hexanone	µg/L	591-78-6	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	µg/L	67-64-1	6000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	µg/L	71-43-2	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	µg/L	75-25-2	4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	74-83-9	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	75-15-0	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	56-23-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	108-90-7	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	µg/L	75-00-3	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	67-66-3	70	0.43 J	0.31 J	0.28 J	0.49 J	0.51 J	1 U	0.45 J	0.63 J
cis-1,2-Dichloroethene	µg/L	156-59-2	70	29.2	23.4	20	34.4	28.1	11.9	23	35.1
Dibromochloromethane	µg/L	124-48-1	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	75-71-8	1000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Ethylbenzene	µg/L	100-41-4	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	98-82-8	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl acetate	µg/L	79-20-9	7000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl ethyl ketone (2-Butanone)	µg/L	78-93-3	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl tert butyl ether	µg/L	1634-04-4	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene chloride	µg/L	75-09-2	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	100-42-5	100	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Tetrachloroethene	µg/L	127-18-4	1	1.7	2.5	1.4	2.2	3.5	1.1	5	4.5
Toluene	µg/L	108-88-3	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	156-60-5	100	0.41 J	0.22 J	0.29 J	0.4 J	0.48 J	1 U	1 U	0.45 J
Trichloroethene	µg/L	79-01-6	1	115	90.8	73.4	112	109	40.2	93.5	132
Trichlorofluoromethane	µg/L	75-69-4	2000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	µg/L	75-01-4	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene (Total)	µg/L	1330-20-7	1000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:

Concentrations which exceed the ROD Performance Standards are highlighted blue

For some parameters the laboratory reporting limit exceeds the ROD Performance Standard. In cases where the laboratory reporting limit exceeds the ROD Performance Standard, and the parameter was not detected at above the laboratory reporting limit, the value reported is the laboratory reporting limit and it is ***italicized and brown***

J - Estimated value

U - Not detected above the laboratory reporting limit

Table 4: Shallow Aquifer Analytical Data Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Station Name	Units	CAS Number	ROD Performance Standards	MW-11S												
Sample Date				3/11/2015	3/11/2015	6/9/2015	6/9/2015	10/8/2015	12/2/2015	3/22/2016	3/22/2016	8/11/2016	10/18/2016	10/18/2016	11/30/2016	11/30/2016
Field Sample ID				DUP-01.20150311	MW-11S.20150311	DUP-01.20150609	MW-11S.20150609	MW-11S.20151008	MW-11S.20151202	DUP-01.20160322	MW-11S.20160322	MW-11S.20160811	DUP-01.20161018	MW-11S.20161018	DUP-01.20161130	MW-11S.20161130
Sample Matrix				Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Dissolved Gases																
Ethane	µg/L	74-84-0		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.1 U	0.002 U	0.002 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U
Ethene	µg/L	74-85-1		0.037	0.038	0.003 U	0.003 U	0.004 U	0.044 J	0.004 U	0.004 U	0.092 J	0.001 U	0.001 U	0.001 U	0.001 U
Methane	µg/L	74-82-8		0.042 U	0.042 U	0.042 U	0.042 U	6.1	0.5 U	0.037 U	0.037 U	0.1 J	0.027 U	0.027 U	0.027 U	0.027 U
General Chemistry																
Alkalinity, Total	µg/L	ALK		4,900	3,400	3,200	2,100	5000 U	5000 U	5000 U	5000 U	4,300	5000 U	5000 U	5000 U	5000 U
Nitrate	µg/L	14797-55-8		1,400	1,300	2,000	2,000	1,500	800 U	1,400	1,400	1,900	1,900	1,900	1,600	1,700
Nitrate and Nitrite	µg/L	OER-100-51		1,400	1,300	2,000	2,000	1,500	800 U	1,400	1,400	1,900	1,900	1,900	1,600	1,700
Nitrite	µg/L	14797-65-0		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Sulfate	µg/L	14808-79-8		5,500	5,700	4,100	4,100	10000 U	4,300	3,600	3,500	4,200	6,500	4,500	3,800	3,800
Total Organic Carbon	µg/L			920	890	620	610	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
Total Suspended Solids	mg/l	TSS		4 U	4 U	4 U	4 U	1.4	3.1	4 U	4 U	4 U	4 U	4 U	4	0.7 J
Metals																
Iron (Dissolved)	µg/L	7439-89-6		50 U	3.9	1.5	1.7	50 U	50 U	50 U	50 U	50 U	50	50 U	50 U	2.7
Iron (Total)	µg/L	7439-89-6		105	102	4.4	5.5	50 U	82.7	50 U	50 U	50 U	50 U	50 U	50 U	11.7
Manganese (Dissolved)	µg/L	7439-96-5		16.1	16.3	26.8	27.1	21.2	17.9	18	16.9	20.7	22.4	23.2	37.9	38.9
Manganese (Total)	µg/L	7439-96-5		24.6	25	26.8	27.3	34.1	35.9	27.5	28.1	26.3	23.3	23.2	41.6	41.5
VOCs																
1,1,1-Trichloroethane	µg/L	71-55-6	30	1 U	1 U	1 U	0.2 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.26 J	1
1,1,2,2-Tetrachloroethane	µg/L	79-34-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	79-00-5	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane (Freon 113)	µg/L	76-13-1	20000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethane	µg/L	75-34-3	50	2.5	2.4	1.9	1.7	1.7	2.6	2.5	2.2	2.7	1.5	1.7	0.96 J	1.1 J
1,1-Dichloroethene	µg/L	75-35-4	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	µg/L	120-82-1	9	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dibromo-3-chloropropane	µg/L	96-12-8	0.02	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***	***2 U***
1,2-Dibromoethane	µg/L	106-93-4	0.03	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***	***1 U***
1,2-Dichlorobenzene	µg/L	95-50-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	µg/L	107-06-2	2	0.61 J	0.67 J	1.2	1.2	0.92 J	0.75 J	0.68 J	0.67 J	0.95 J	0.5 J	0.53 J	0.32 J	0.32 J
1,2-Dichloropropane	µg/L	78-87-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	µg/L	541-73-1	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	106-46-7	75	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane	µg/L	123-91-1		-	-	-	-	0.21 U	0.21 U	0.1	1.29 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
2-Hexanone	µg/L	591-78-6	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	µg/L	67-64-1	6000	5 U	5 U	9	6.6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	µg/L	71-43-2	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	µg/L	75-25-2	4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	74-83-9	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	75-15-0	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	56-23-5	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	108-90-7	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	µg/L	75-00-3	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	67-66-3	70	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	µg/L	156-59-2	70	4.9	5	6.9	6.6	4.9	6.5	5.2	5.2	6.7	4.2	4.5	3.1	3.4
Dibromochloromethane	µg/L	124-48-1	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	75-71-8	1000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Ethylbenzene	µg/L	100-41-4	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	98-82-8	700	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl acetate	µg/L	79-20-9	7000	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl ethyl ketone (2-Butanone)	µg/L	78-93-3	300	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl tert butyl ether	µg/L	1634-04-4	70	1 U	1 U	0.48 J	0.42 J	0.46 J	1 U	1 U	1 U	0.33 J	1 U	1 U	0.21 J	1
Methylene chloride	µg/L	75-09-2	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	100-42-5	100	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Tetrachloroethene	µg/L	127-18-4	1	2.1	2	1.8	1.8	1.5	2.2	2.1	2	1.9	1.6	1.6	1.4	1.4
Toluene	µg/L	108-88-3	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	156-60-5	100	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	79-01-6	1	8.7	8.9	10.6	10.2	8.6	10.2	8.5	8.3	9.6	7.7	7.9	7	7.1
Trichlorofluoromethane	µg/L	75-69-4	2000	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	µg/L	75-01-4	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylene (Total)	µg/L	1330-20-7	1000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:

Concentrations which exceed the ROD Performance Standards are highlighted blue

For some parameters the laboratory reporting limit exceeds the ROD Performance Standard. In cases where the laboratory reporting limit exceeds the ROD Performance Standard, and the parameter was not detected at above the laboratory reporting limit, the value reported is the laboratory reporting limit and it is ***italicized and brown***

J - Estimated value

U - Not detected above the laboratory reporting limit

Table 5: Deep Aquifer Analytical Data Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Well ID	Units	CAS Number	NJ Groundwater Quality Standard 2015	US EPA MCLs	GM-01D		
Sample Date					10/26/2015	10/19/2016	10/19/2016
Field Sample ID					GM-1D.20151026	DUP-02.20161019	GM-01D.20161019
Sample Matrix					Groundwater	Groundwater	Groundwater
VOCs							
1,1,1-Trichloroethane	µg/L	71-55-6	30	200	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	79-34-5	1		1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	79-00-5	3	5	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane (Freon 113)	µg/L	76-13-1	20000		2 U	2 U	2 U
1,1-Dichloroethane	µg/L	75-34-3	50		1.1	1	1
1,1-Dichloroethene	µg/L	75-35-4	1	7	0.23 J	0.31 J	0.34 J
1,2,4-Trichlorobenzene	µg/L	120-82-1	9	70	2 U	2 U	2 U
1,2-Dibromo-3-chloropropane	µg/L	96-12-8	0.02	0.2	***2 U***	***2 U***	***2 U***
1,2-Dibromoethane	µg/L	106-93-4	0.03	0.05	***1 U***	***1 U***	***1 U***
1,2-Dichlorobenzene	µg/L	95-50-1	600	600	0.39 J	1	0.27 J
1,2-Dichloroethane	µg/L	107-06-2	2	5	0.9 J	0.74 J	0.91 J
1,2-Dichloropropane	µg/L	78-87-5	1	5	0.32 J	1 U	1 U
1,3-Dichlorobenzene	µg/L	541-73-1	600		1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	106-46-7	75	75	0.89 J	0.41 J	0.45 J
2-Hexanone	µg/L	591-78-6	300		5 U	5 U	5 U
Acetone	µg/L	67-64-1	6000		5 U	37.5	34.7
Benzene	µg/L	71-43-2	1	5	1.9	1.4	1.5
Bromoform	µg/L	75-25-2	4		1 U	1 U	1 U
Bromomethane	µg/L	74-83-9	10		1 U	1 U	1 U
Carbon disulfide	µg/L	75-15-0	700		1 U	1 U	1 U
Carbon tetrachloride	µg/L	56-23-5	1	5	1 U	1 U	1 U
Chlorobenzene	µg/L	108-90-7	50	100	0.94 J	2	1.9
Chloroethane	µg/L	75-00-3	5		1 U	1 U	1 U
Chloroform	µg/L	67-66-3	70		0.3 J	1 U	1 U
cis-1,2-Dichloroethene	µg/L	156-59-2	70	70	2.9	3.4	3.2
Dibromochloromethane	µg/L	124-48-1	1		1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	75-71-8	1000		2 U	2 U	2 U
Ethylbenzene	µg/L	100-41-4	700	700	1 U	1 U	1 U
Isopropylbenzene	µg/L	98-82-8	700		1 U	1 U	1 U
Methyl acetate	µg/L	79-20-9	7000		5 U	5 U	5 U
Methyl ethyl ketone (2-Butanone)	µg/L	78-93-3	300		5 U	5 U	5 U
Methyl tert butyl ether	µg/L	1634-04-4	70		12.8	1.3	1.5
Methylene chloride	µg/L	75-09-2	3	5	1 U	1 U	1 U
Styrene	µg/L	100-42-5	100	100	2 U	2 U	2 U
Tetrachloroethene	µg/L	127-18-4	1	5	0.79 J	0.47 J	0.46 J
Toluene	µg/L	108-88-3	600	1000	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	156-60-5	100	100	1 U	1 U	1 U
Trichloroethene	µg/L	79-01-6	1	5	0.79 J	0.81 J	0.74 J
Trichlorofluoromethane	µg/L	75-69-4	2000		2 U	2 U	2 U
Vinyl Chloride	µg/L	75-01-4	1	2	1 U	1 U	1 U
Xylene (Total)	µg/L	1330-20-7	1000	10000	1 U	1 U	1 U

Notes:

-- Not analyzed

Concentrations which exceed the NJ GWQS are highlighted blue

Concentrations which exceed the NJ GWQS and US EPA GW MCLs are highlighted blue and **bolded**

For some parameters the reporting limit exceeds the NJDEP GWQS. In cases where the reporting limit exceeds the NJDEP GWQS, and the parameter was not detected above the reporting limit, the value reported is the reporting limit and it is ***italicized and brown***

J - Estimated value

U - Non-detectable

Table 5: Deep Aquifer Analytical Data Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Well ID	Units	CAS Number	NJ Groundwater Quality Standard 2015	US EPA MCLs	GM-02D		GM-03D	
Sample Date					10/8/2015	10/18/2016	10/7/2015	10/18/2016
Field Sample ID					GM-2D.20151008	GM-02D.20161018	GM-3D.20151007	GM-03D.20161018
Sample Matrix					Groundwater	Groundwater	Groundwater	Groundwater
VOCs								
1,1,1-Trichloroethane	µg/L	71-55-6	30	200	1 U	0.29 J	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	79-34-5	1		1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	79-00-5	3	5	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane (Freon 113)	µg/L	76-13-1	20000		2 U	2 U	2 U	2 U
1,1-Dichloroethane	µg/L	75-34-3	50		1.1	1.7	2	2.7
1,1-Dichloroethene	µg/L	75-35-4	1	7	0.3 J	0.67 J	0.75 J	1.1
1,2,4-Trichlorobenzene	µg/L	120-82-1	9	70	2 U	2 U	0.21 J	2 U
1,2-Dibromo-3-chloropropane	µg/L	96-12-8	0.02	0.2	***2 U***	***2 U***	***2 U***	***2 U***
1,2-Dibromoethane	µg/L	106-93-4	0.03	0.05	***1 U***	***1 U***	***1 U***	***1 U***
1,2-Dichlorobenzene	µg/L	95-50-1	600	600	1 U	1 U	0.23 J	1 U
1,2-Dichloroethane	µg/L	107-06-2	2	5	0.28 J	0.54 J	1.3	1.2
1,2-Dichloropropane	µg/L	78-87-5	1	5	0.6 J	0.98 J	1.3	1.8
1,3-Dichlorobenzene	µg/L	541-73-1	600		1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	106-46-7	75	75	1 U	1 U	0.43 J	0.24 J
2-Hexanone	µg/L	591-78-6	300		5 U	5 U	5 U	5 U
Acetone	µg/L	67-64-1	6000		4.4 J	38	5 U	41.8
Benzene	µg/L	71-43-2	1	5	1 U	1 U	0.26 J	1 U
Bromoform	µg/L	75-25-2	4		1 U	1 U	1 U	1 U
Bromomethane	µg/L	74-83-9	10		1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	75-15-0	700		1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	56-23-5	1	5	1 U	1 U	0.52 J	0.7 J
Chlorobenzene	µg/L	108-90-7	50	100	0.24 J	0.38 J	1.4	0.97 J
Chloroethane	µg/L	75-00-3	5		1 U	1 U	1 U	1 U
Chloroform	µg/L	67-66-3	70		0.26 J	0.49 J	1.1	1.6
cis-1,2-Dichloroethene	µg/L	156-59-2	70	70	3.2	5.5	6.7	10.3
Dibromochloromethane	µg/L	124-48-1	1		1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	75-71-8	1000		2 U	2 U	2 U	2 U
Ethylbenzene	µg/L	100-41-4	700	700	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	98-82-8	700		1 U	1 U	1 U	1 U
Methyl acetate	µg/L	79-20-9	7000		5 U	5 U	5 U	5 U
Methyl ethyl ketone (2-Butanone)	µg/L	78-93-3	300		5 U	5 U	5 U	5 U
Methyl tert butyl ether	µg/L	1634-04-4	70		6.9	1.3	14.5	2.2
Methylene chloride	µg/L	75-09-2	3	5	1 U	1 U	0.25 J	1 U
Styrene	µg/L	100-42-5	100	100	2 U	2 U	2 U	2 U
Tetrachloroethene	µg/L	127-18-4	1	5	0.61 J	1	3.5	4.9
Toluene	µg/L	108-88-3	600	1000	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	156-60-5	100	100	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	79-01-6	1	5	1.4	2.4	4.2	**7.5**
Trichlorofluoromethane	µg/L	75-69-4	2000		2 U	2 U	2 U	2 U
Vinyl Chloride	µg/L	75-01-4	1	2	1 U	1 U	1 U	1 U
Xylene (Total)	µg/L	1330-20-7	1000	10000	1 U	1 U	1 U	1 U

Notes:

-- Not analyzed

Concentrations which exceed the NJ GWQS are highlighted blue

Concentrations which exceed the NJ GWQS and US EPA GW MCLs are highlighted blue and **bolded**

For some parameters the reporting limit exceeds the NJDEP GWQS. In cases where the reporting limit exceeds the NJDEP GWQS, and the parameter was not detected above the reporting limit, the value reported is the reporting limit and it is ***italicized and brown***

J - Estimated value

U - Non-detectable

Table 5: Deep Aquifer Analytical Data Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Well ID	Units	CAS Number	NJ Groundwater Quality Standard 2015	US EPA MCLs	GM-04D		GM-05D	
Sample Date					10/26/2015	10/19/2016	10/8/2015	10/18/2016
Field Sample ID					GM-4D.20151026	GM-04D.20161019	GM-5D.20151008	GM-05D.20161018
Sample Matrix					Groundwater	Groundwater	Groundwater	Groundwater
VOCs								
1,1,1-Trichloroethane	µg/L	71-55-6	30	200	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	79-34-5	1		1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	79-00-5	3	5	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane (Freon 113)	µg/L	76-13-1	20000		2 U	2 U	2 U	2 U
1,1-Dichloroethane	µg/L	75-34-3	50		4.1	4.2	3	4.8
1,1-Dichloroethene	µg/L	75-35-4	1	7	0.56 J	0.64 J	0.63 J	1.2
1,2,4-Trichlorobenzene	µg/L	120-82-1	9	70	0.51 J	2 U	2 U	2 U
1,2-Dibromo-3-chloropropane	µg/L	96-12-8	0.02	0.2	***2 U***	***2 U***	***2 U***	***2 U***
1,2-Dibromoethane	µg/L	106-93-4	0.03	0.05	***1 U***	***1 U***	***1 U***	***1 U***
1,2-Dichlorobenzene	µg/L	95-50-1	600	600	0.36 J	0.25 J	1 U	1 U
1,2-Dichloroethane	µg/L	107-06-2	2	5	0.68 J	0.72 J	0.61 J	0.87 J
1,2-Dichloropropane	µg/L	78-87-5	1	5	2	2.1	2.2	3.9
1,3-Dichlorobenzene	µg/L	541-73-1	600		1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	106-46-7	75	75	0.47 J	0.23 J	1 U	1 U
2-Hexanone	µg/L	591-78-6	300		5 U	5 U	5 U	5 U
Acetone	µg/L	67-64-1	6000		5 U	36.4	5 U	5 U
Benzene	µg/L	71-43-2	1	5	0.23 J	0.22 J	1 U	1 U
Bromoform	µg/L	75-25-2	4		1 U	1 U	1 U	1 U
Bromomethane	µg/L	74-83-9	10		1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	75-15-0	700		0.31 J	1 U	1 U	1 U
Carbon tetrachloride	µg/L	56-23-5	1	5	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	108-90-7	50	100	1.4	1.2	0.35 J	0.35 J
Chloroethane	µg/L	75-00-3	5		1 U	1 U	1 U	1 U
Chloroform	µg/L	67-66-3	70		0.45 J	0.53 J	1 U	0.51 J
cis-1,2-Dichloroethene	µg/L	156-59-2	70	70	12.9	13.5	9.6	14
Dibromochloromethane	µg/L	124-48-1	1		1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	75-71-8	1000		2 U	2 U	2 U	2 U
Ethylbenzene	µg/L	100-41-4	700	700	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	98-82-8	700		1 U	1 U	1 U	1 U
Methyl acetate	µg/L	79-20-9	7000		5 U	5 U	5 U	5 U
Methyl ethyl ketone (2-Butanone)	µg/L	78-93-3	300		5 U	5 U	5 U	5 U
Methyl tert butyl ether	µg/L	1634-04-4	70		64.4	6.6	43.1	5.4
Methylene chloride	µg/L	75-09-2	3	5	1 U	1 U	1 U	1 U
Styrene	µg/L	100-42-5	100	100	2 U	2 U	2 U	2 U
Tetrachloroethene	µg/L	127-18-4	1	5	1.8	1.2	0.79 J	1.5
Toluene	µg/L	108-88-3	600	1000	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	156-60-5	100	100	1 U	1 U	0.78 J	1.3
Trichloroethene	µg/L	79-01-6	1	5	4.1	5	4.7	**6.7**
Trichlorofluoromethane	µg/L	75-69-4	2000		2 U	2 U	2 U	2 U
Vinyl Chloride	µg/L	75-01-4	1	2	0.6 J	0.73 J	0.57 J	0.4 J
Xylene (Total)	µg/L	1330-20-7	1000	10000	1 U	1 U	1 U	1 U

Notes:

-- Not analyzed

Concentrations which exceed the NJ GWQS are highlighted blue

Concentrations which exceed the NJ GWQS and US EPA GW MCLs are highlighted blue and **bolded**

For some parameters the reporting limit exceeds the NJDEP GWQS. In cases where the reporting limit exceeds the NJDEP GWQS, and the parameter was not detected above the reporting limit, the value reported is the reporting limit and it is ***italicized and brown***

J - Estimated value

U - Non-detectable

Table 5: Deep Aquifer Analytical Data Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Well ID	Units	CAS Number	NJ Groundwater Quality Standard 2015	US EPA MCLs	GM-06D		GM-07D	
Sample Date					10/8/2015	10/18/2016	10/7/2015	10/20/2016
Field Sample ID					GM-6D.20151008	GM-06D.20161018	GM-7D.20151007	GM-07D.20161020
Sample Matrix					Groundwater	Groundwater	Groundwater	Groundwater
VOCs								
1,1,1-Trichloroethane	µg/L	71-55-6	30	200	0.92 J	0.85 J	0.23 J	0.25 J
1,1,2,2-Tetrachloroethane	µg/L	79-34-5	1		1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	µg/L	79-00-5	3	5	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane (Freon 113)	µg/L	76-13-1	20000		2 U	2 U	2 U	2 U
1,1-Dichloroethane	µg/L	75-34-3	50		4	3.7	2.3	2.3
1,1-Dichloroethene	µg/L	75-35-4	1	7	1.3	1.3	0.65 J	0.75 J
1,2,4-Trichlorobenzene	µg/L	120-82-1	9	70	2 U	2 U	0.27 J	2 U
1,2-Dibromo-3-chloropropane	µg/L	96-12-8	0.02	0.2	***2 U***	***2 U***	***2 U***	***2 U***
1,2-Dibromoethane	µg/L	106-93-4	0.03	0.05	***1 U***	***1 U***	***1 U***	***1 U***
1,2-Dichlorobenzene	µg/L	95-50-1	600	600	1 U	1 U	0.54 J	0.41 J
1,2-Dichloroethane	µg/L	107-06-2	2	5	0.66 J	0.42 J	1.4	1.5
1,2-Dichloropropane	µg/L	78-87-5	1	5	2.9	2.4	1.2	1.4
1,3-Dichlorobenzene	µg/L	541-73-1	600		1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	µg/L	106-46-7	75	75	1 U	1 U	0.89 J	0.73 J
2-Hexanone	µg/L	591-78-6	300		5 U	5 U	5 U	5 U
Acetone	µg/L	67-64-1	6000		5 U	55.1	5 U	17.8
Benzene	µg/L	71-43-2	1	5	1 U	1 U	0.33 J	0.4 J
Bromoform	µg/L	75-25-2	4		1 U	1 U	1 U	1 U
Bromomethane	µg/L	74-83-9	10		1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	75-15-0	700		1 U	1 U	1 U	1 U
Carbon tetrachloride	µg/L	56-23-5	1	5	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	108-90-7	50	100	1 U	1 U	2.1	2.3
Chloroethane	µg/L	75-00-3	5		1 U	1 U	1 U	1 U
Chloroform	µg/L	67-66-3	70		1.5	1.3	0.95 J	1.1
cis-1,2-Dichloroethene	µg/L	156-59-2	70	70	14	12.6	9	9.2
Dibromochloromethane	µg/L	124-48-1	1		1 U	1 U	1 U	1 U
Dichlorodifluoromethane	µg/L	75-71-8	1000		2 U	2 U	2 U	2 U
Ethylbenzene	µg/L	100-41-4	700	700	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	98-82-8	700		1 U	1 U	1 U	1 U
Methyl acetate	µg/L	79-20-9	7000		5 U	5 U	5 U	5 U
Methyl ethyl ketone (2-Butanone)	µg/L	78-93-3	300		5 U	5 U	5 U	5 U
Methyl tert butyl ether	µg/L	1634-04-4	70		35.1	3.4	11.6	1.6
Methylene chloride	µg/L	75-09-2	3	5	1 U	1 U	0.33 J	1 U
Styrene	µg/L	100-42-5	100	100	2 U	2 U	2 U	2 U
Tetrachloroethene	µg/L	127-18-4	1	5	**7.5**	4.7	2.1	1.3
Toluene	µg/L	108-88-3	600	1000	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	156-60-5	100	100	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	79-01-6	1	5	**9.9**	**8.6**	**12**	**10.7**
Trichlorofluoromethane	µg/L	75-69-4	2000		2 U	2 U	2 U	2 U
Vinyl Chloride	µg/L	75-01-4	1	2	1 U	1 U	0.23 J	1 U
Xylene (Total)	µg/L	1330-20-7	1000	10000	1 U	1 U	1 U	1 U

Notes:

-- Not analyzed

Concentrations which exceed the NJ GWQS are highlighted blue

Concentrations which exceed the NJ GWQS and US EPA GW MCLs are highlighted blue and **bolded**

For some parameters the reporting limit exceeds the NJDEP GWQS. In cases where the reporting limit exceeds the NJDEP GWQS, and the parameter was not detected above the reporting limit, the value reported is the reporting limit and it is ***italicized and brown***

J - Estimated value

U - Non-detectable

Table 5: Deep Aquifer Analytical Data Summary
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Well ID	Units	CAS Number	NJ Groundwater Quality Standard 2015	US EPA MCLs	GM-08D	
Sample Date					10/8/2015	10/20/2016
Field Sample ID					GM-8D.20151008	GM-08D.20161020
Sample Matrix					Groundwater	Groundwater
VOCs						
1,1,1-Trichloroethane	µg/L	71-55-6	30	200	0.22 J	0.46 J
1,1,2,2-Tetrachloroethane	µg/L	79-34-5	1		1 U	1 U
1,1,2-Trichloroethane	µg/L	79-00-5	3	5	1 U	1 U
1,1,2-Trichlorotrifluoroethane (Freon 113)	µg/L	76-13-1	20000		2 U	2 U
1,1-Dichloroethane	µg/L	75-34-3	50		6.4	8.7
1,1-Dichloroethene	µg/L	75-35-4	1	7	0.57 J	0.97 J
1,2,4-Trichlorobenzene	µg/L	120-82-1	9	70	2 U	2 U
1,2-Dibromo-3-chloropropane	µg/L	96-12-8	0.02	0.2	***2 U***	***2 U***
1,2-Dibromoethane	µg/L	106-93-4	0.03	0.05	***1 U***	***1 U***
1,2-Dichlorobenzene	µg/L	95-50-1	600	600	0.46 J	0.27 J
1,2-Dichloroethane	µg/L	107-06-2	2	5	4.2	**6**
1,2-Dichloropropane	µg/L	78-87-5	1	5	0.77 J	0.4 J
1,3-Dichlorobenzene	µg/L	541-73-1	600		1 U	1 U
1,4-Dichlorobenzene	µg/L	106-46-7	75	75	1.1	0.69 J
2-Hexanone	µg/L	591-78-6	300		5 U	5 U
Acetone	µg/L	67-64-1	6000		4.2 J	35.4
Benzene	µg/L	71-43-2	1	5	0.41 J	0.41 J
Bromoform	µg/L	75-25-2	4		1 U	1 U
Bromomethane	µg/L	74-83-9	10		1 U	1 U
Carbon disulfide	µg/L	75-15-0	700		1 U	1 U
Carbon tetrachloride	µg/L	56-23-5	1	5	1 U	1 U
Chlorobenzene	µg/L	108-90-7	50	100	1.8	1.5
Chloroethane	µg/L	75-00-3	5		1 U	1 U
Chloroform	µg/L	67-66-3	70		0.43 J	0.28 J
cis-1,2-Dichloroethene	µg/L	156-59-2	70	70	17.5	29.5
Dibromochloromethane	µg/L	124-48-1	1		1 U	1 U
Dichlorodifluoromethane	µg/L	75-71-8	1000		2 U	2 U
Ethylbenzene	µg/L	100-41-4	700	700	1 U	1 U
Isopropylbenzene	µg/L	98-82-8	700		1 U	1 U
Methyl acetate	µg/L	79-20-9	7000		5 U	5 U
Methyl ethyl ketone (2-Butanone)	µg/L	78-93-3	300		5 U	5 U
Methyl tert butyl ether	µg/L	1634-04-4	70		3.5	0.31 J
Methylene chloride	µg/L	75-09-2	3	5	0.63 J	1 U
Styrene	µg/L	100-42-5	100	100	2 U	2 U
Tetrachloroethene	µg/L	127-18-4	1	5	4.3	2.9
Toluene	µg/L	108-88-3	600	1000	1 U	1 U
trans-1,2-Dichloroethene	µg/L	156-60-5	100	100	1 U	0.23 J
Trichloroethene	µg/L	79-01-6	1	5	**9.8**	**19**
Trichlorofluoromethane	µg/L	75-69-4	2000		2 U	2 U
Vinyl Chloride	µg/L	75-01-4	1	2	1.3	**2.3**
Xylene (Total)	µg/L	1330-20-7	1000	10000	1 U	1 U

Notes:

-- Not analyzed

Concentrations which exceed the NJ GWQS are highlighted blue

Concentrations which exceed the NJ GWQS and US EPA GW MCLs are highlighted blue and **bolded**

For some parameters the reporting limit exceeds the NJDEP GWQS. In cases where the reporting limit exceeds the NJDEP GWQS, and the parameter was not detected above the reporting limit, the value reported is the reporting limit and it is ***italicized and brown***

J - Estimated value

U - Non-detectable

Location	Location Relative to the Site	PCE	TCE	cDCE	VC	Ethene
GM-01S	On-Site	No Trend	No Trend	No Trend	NA	NA
GM-02S	Off-Site upgradient	Increasing	No Trend	Increasing	Increasing	NA
GM-03RS	On-Site	Stable	Increasing	Decreasing	Stable	NA
GM-05S	Off-Site upgradient	No Trend	Increasing	Increasing	NA	NA
GM-06S	Off-Site downgradient/sidegradient	Increasing	Increasing	Increasing	NA	NA
GM-07S	Off-Site downgradient/sidegradient	Decreasing	Decreasing	Decreasing	NA	NA
GM-08S	Off-Site downgradient/sidegradient	NA	Increasing	Increasing	NA	NA
MW-01	On-Site	Stable	Increasing	Increasing	NA	NA
MW-02	On-Site	Decreasing	No Trend	No Trend	NA	NA
MW-04	On-Site	Stable	Increasing	Increasing	NA	NA
MW-07	Off-Site downgradient/sidegradient	Decreasing	Stable	Stable	NA	NA
MW-09S	Off-Site downgradient/sidegradient	Stable	Stable	Stable	Stable	Stable
MW-10S	Off-Site upgradient	No Trend	Stable	Stable	NA	No Trend
MW-11S	Off-Site downgradient/sidegradient	Stable	Decreasing	Stable	NA	No Trend

Notes:

The full post-Cap data set was used in this analysis (i.e., 2015 and 2016 data).

NA = Not analyzed due to < 50% detection frequency.

“No Trend” does not imply the absence of a trend. It simply means that the Mann-Kendall test could not discern either an upward or downward trend for the given data set.

PCE- Tetrachloroethene

TCE- Trichloroethene

cDCE- cis-1,2-Dichloroethene

VC- Vinyl chloride

Table 7: First-Order Natural Attenuation Rates
Swope Oil and Chemical Company Superfund Site
Year 2 (2016) Annual MNA Report

Well Grouping	Well ID	TCE Attenuation Rate (µg/L per year)		cDCE Attenuation Rate (µg/L per year)	
		Pre-Cap	Post-Cap	Pre-Cap	Post-Cap
On-Site	GM-03RS	-0.05	-0.27	0.02	0.23
	MW-02	-0.11	0.00	0.08	-0.01
	MW-04	-0.03	-0.21	0.26	-0.24
Off-Site Upgradient	GM-02S	-	-	-0.15	-0.62
	MW-10S	-0.56	0.09	-0.68	0.08
Off-Site Downgradient/Sidegradient	GM-07S	0.07	0.26	-0.19	0.38
	MW-09S	0.10	-0.02	0.15	0.16
	MW-11S	0.17	0.16	-	-

Notes:

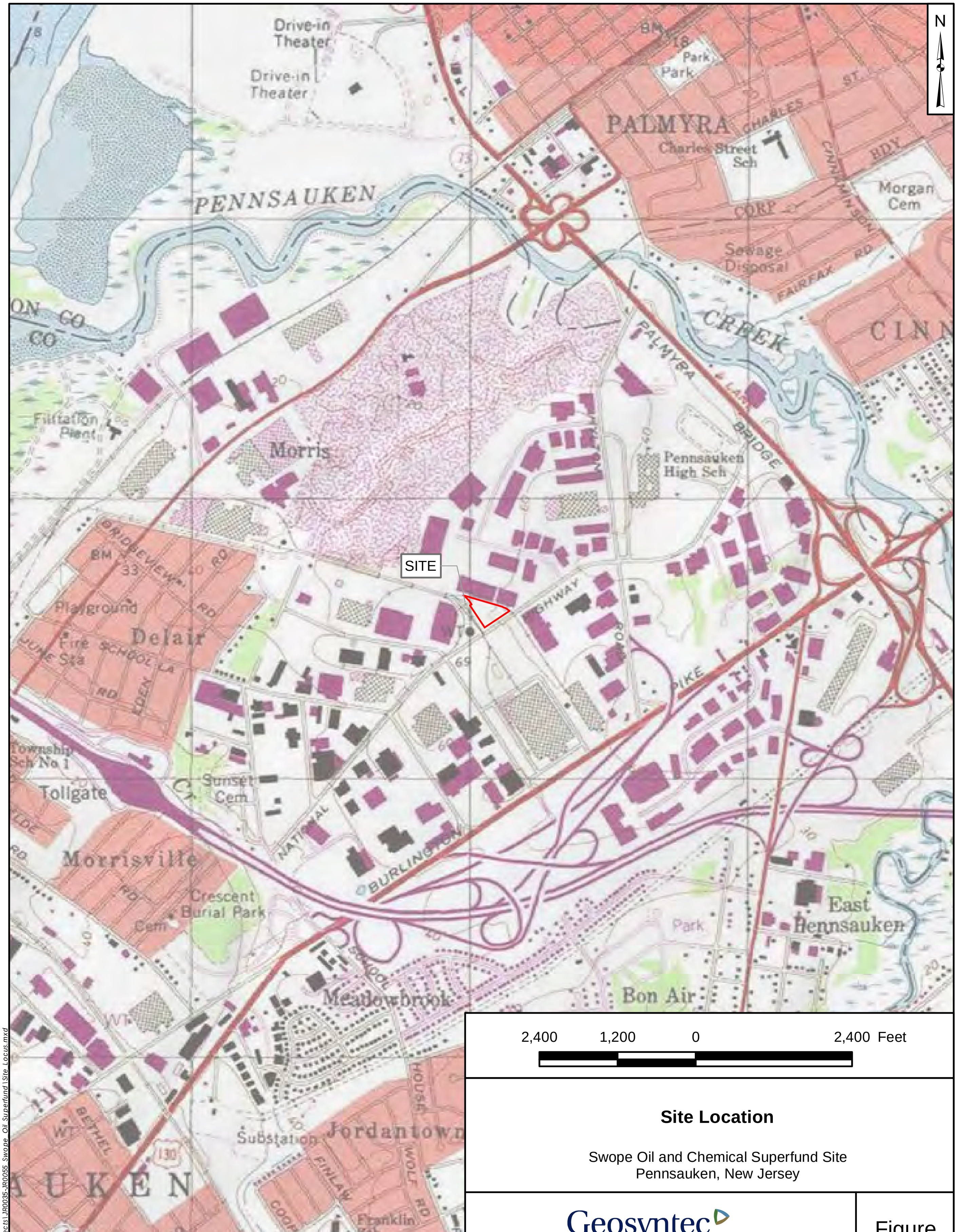
TCE- Trichloroethene

cDCE- cis-1,2-Dichloroethene

Beginning in 2015, first-order natural attenuation rates with respect to concentration versus time were derived for all wells where the concentration of individual COCs was greater than 10 µg/L, in order to evaluate the natural attenuation process in groundwater. Among the Site COCs, only TCE and cDCE were detected at concentrations greater than 10 µg/L in 2015. The data set was then updated with 2016 data and updated rates calculated.

A negative attenuation rate may indicate attenuation is not occuring, or there are too few data points to draw a conclusion.

FIGURES



2,400 1,200 0 2,400 Feet

Site Location

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

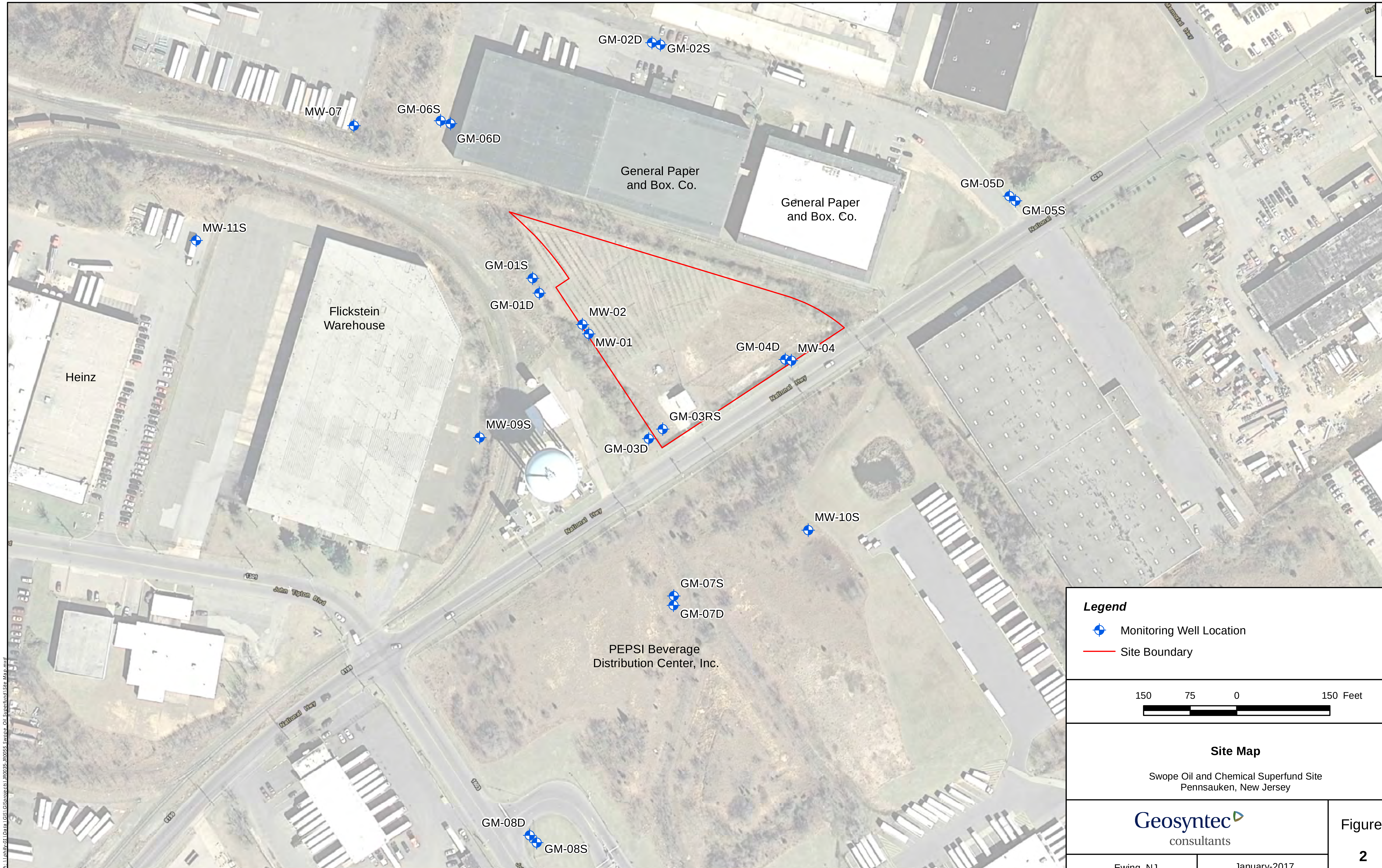
Geosyntec consultants

Figure **1**

Ewing, NJ | March 2016

Base Map: USGS Camden (1999) 7.5 x 7.5 Minute Quadrangle.

Path: P:\GIS\ GISprojects\ JR0035-JR0055_Swope_Oil_Superfund\Site_Locus.mxd



Site Map

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec
consultants

Ewing, NJ	January-2017	Figure 2

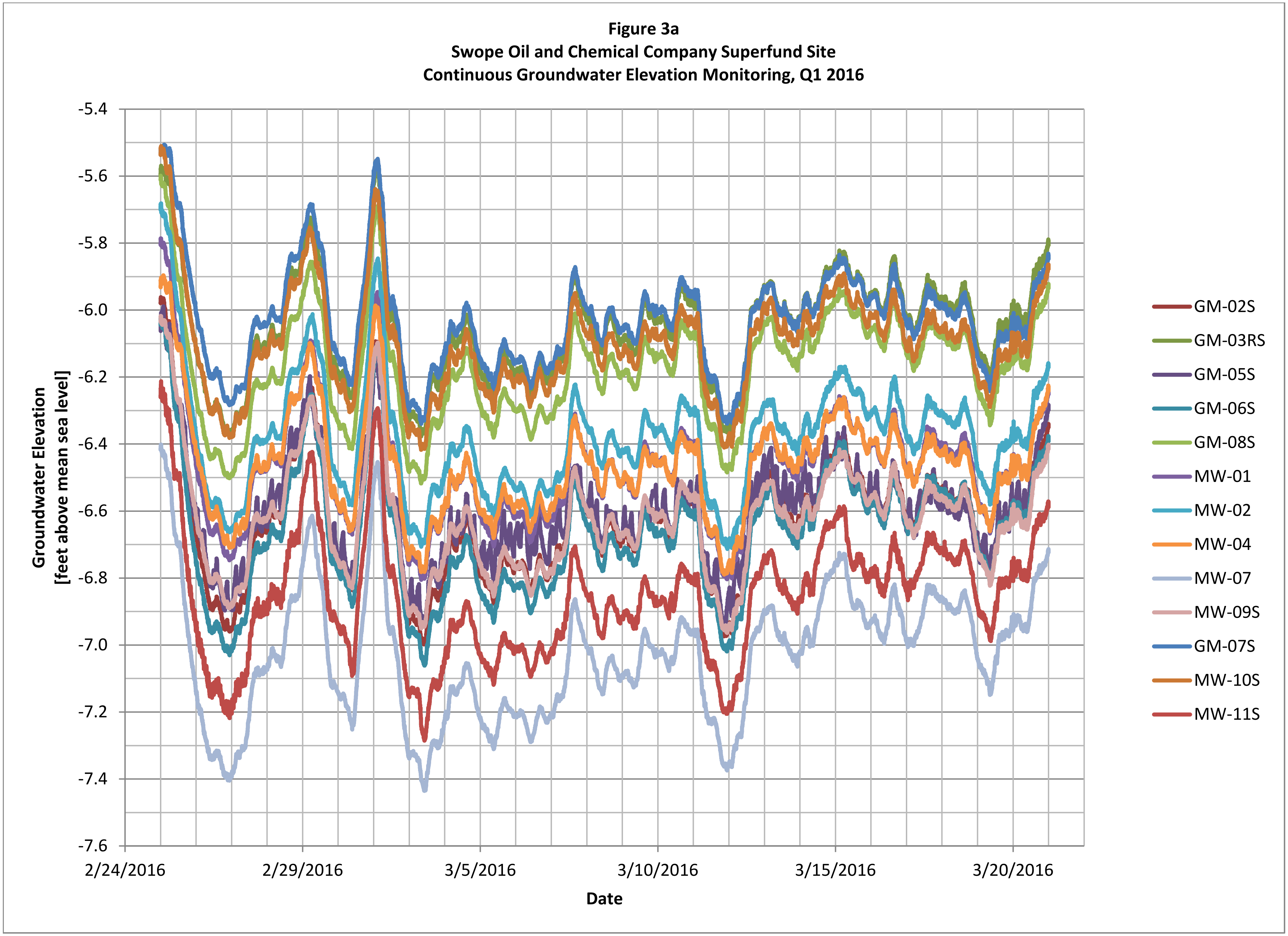
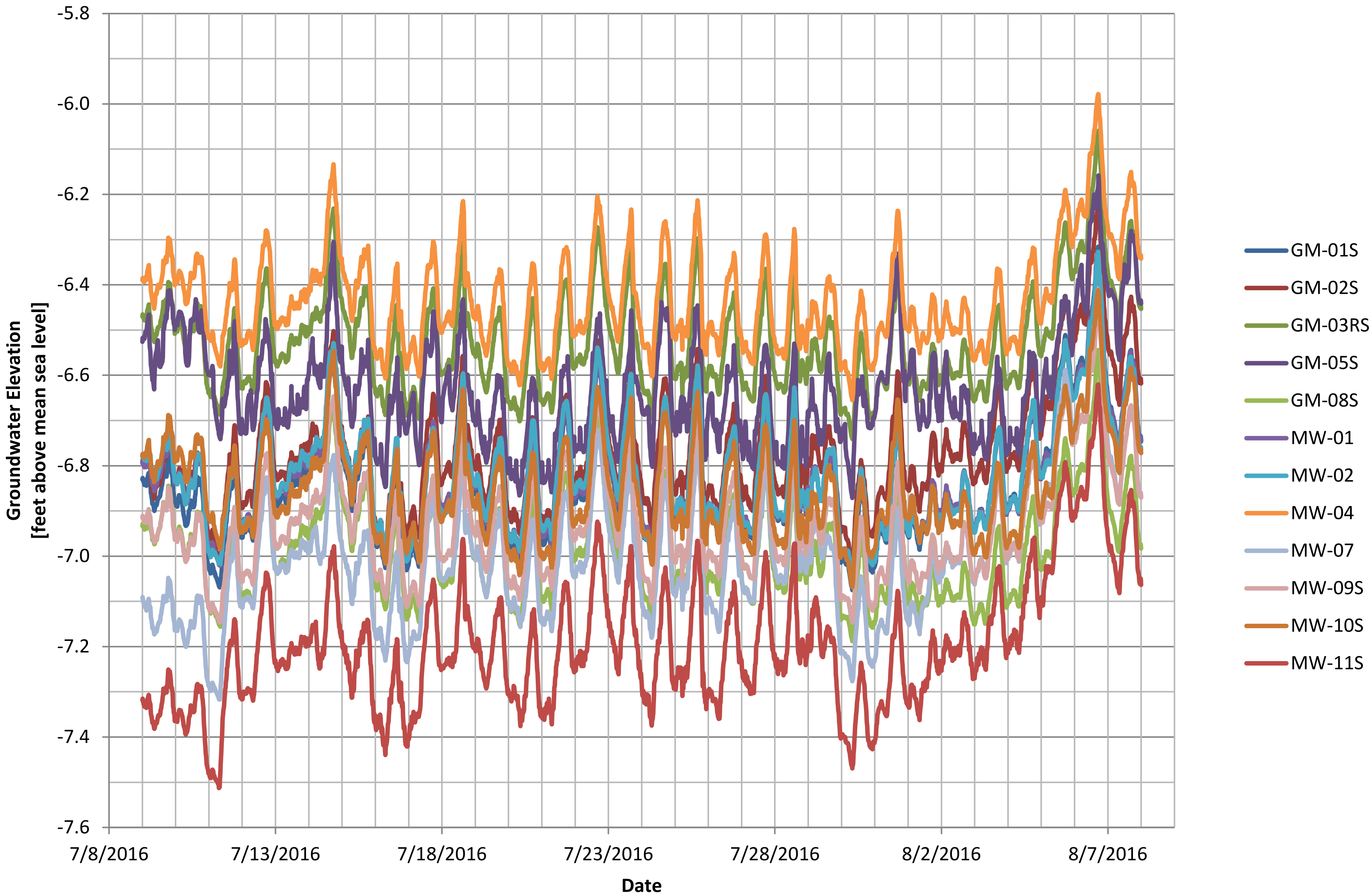


Figure 3a
Swope Oil and Chemical Company Superfund Site
Continuous Groundwater Elevation Monitoring, Q1 2016
Groundwater Elevation
[feet above mean sea level]
-5.4
-5.6
-5.8
-6.0
-6.2
-6.4
-6.6
-6.8
-7.0
-7.2
-7.4
-7.6
2/24/2016
2/29/2016
3/5/2016
3/10/2016
3/15/2016
3/20/2016
Date
GM-02S
GM-03RS
GM-05S
GM-06S
GM-08S
MW-01
MW-02
MW-04
MW-07
MW-09S
GM-07S
MW-10S
MW-11S

Figure 3b
Swope Oil and Chemical Company Superfund Site
Continuous Groundwater Elevation Monitoring, Q2 2016



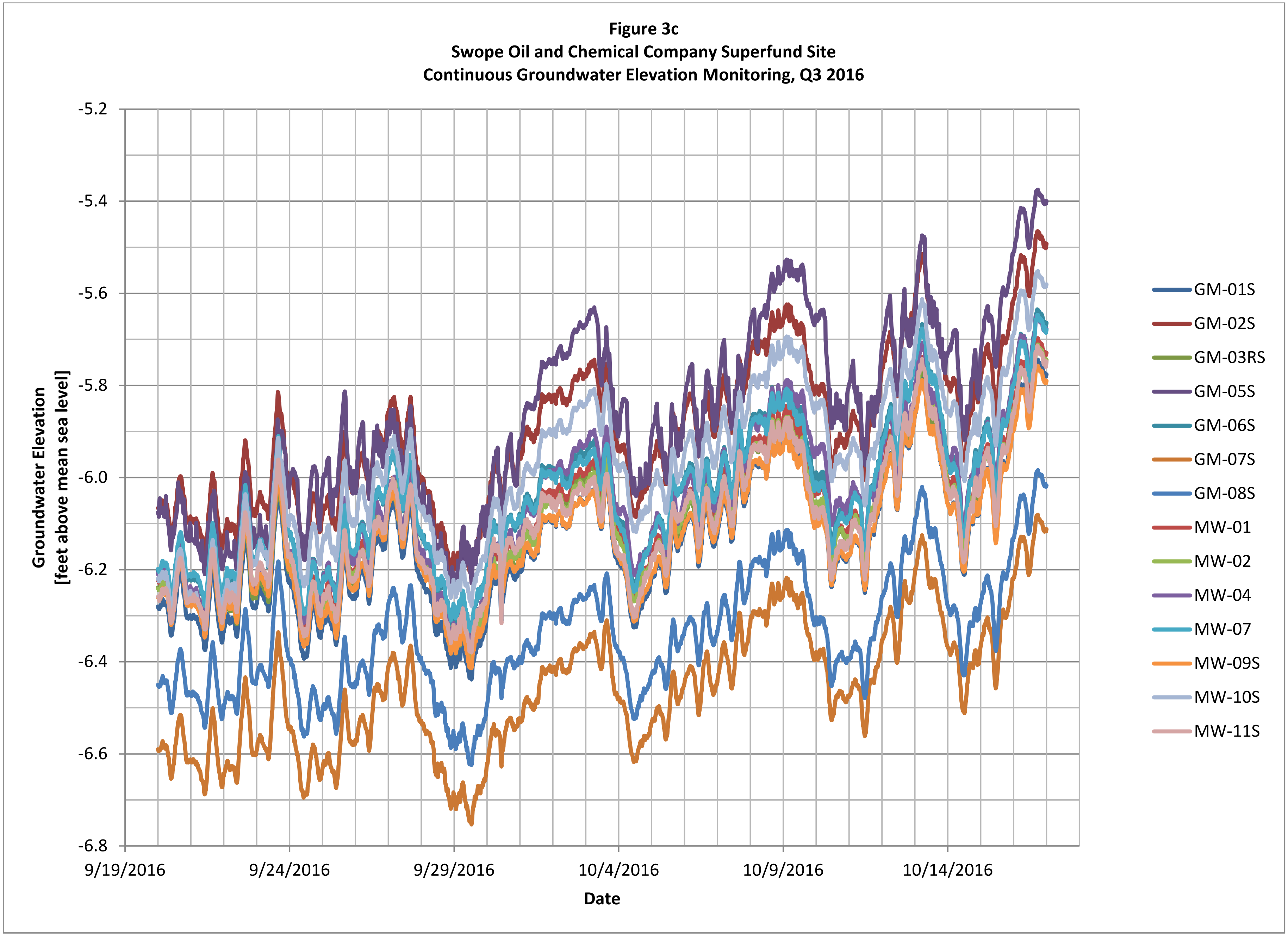


Figure 3c
Swope Oil and Chemical Company Superfund Site
Continuous Groundwater Elevation Monitoring, Q3 2016
Groundwater Elevation
[feet above mean sea level]
-5.2
-5.4
-5.6
-5.8
-6.0
-6.2
-6.4
-6.6
-6.8
9/19/2016
9/24/2016
9/29/2016
10/4/2016
10/9/2016
10/14/2016
Date
GM-01S
GM-02S
GM-03RS
GM-05S
GM-06S
GM-07S
GM-08S
MW-01
MW-02
MW-04
MW-07
MW-09S
MW-10S
MW-11S

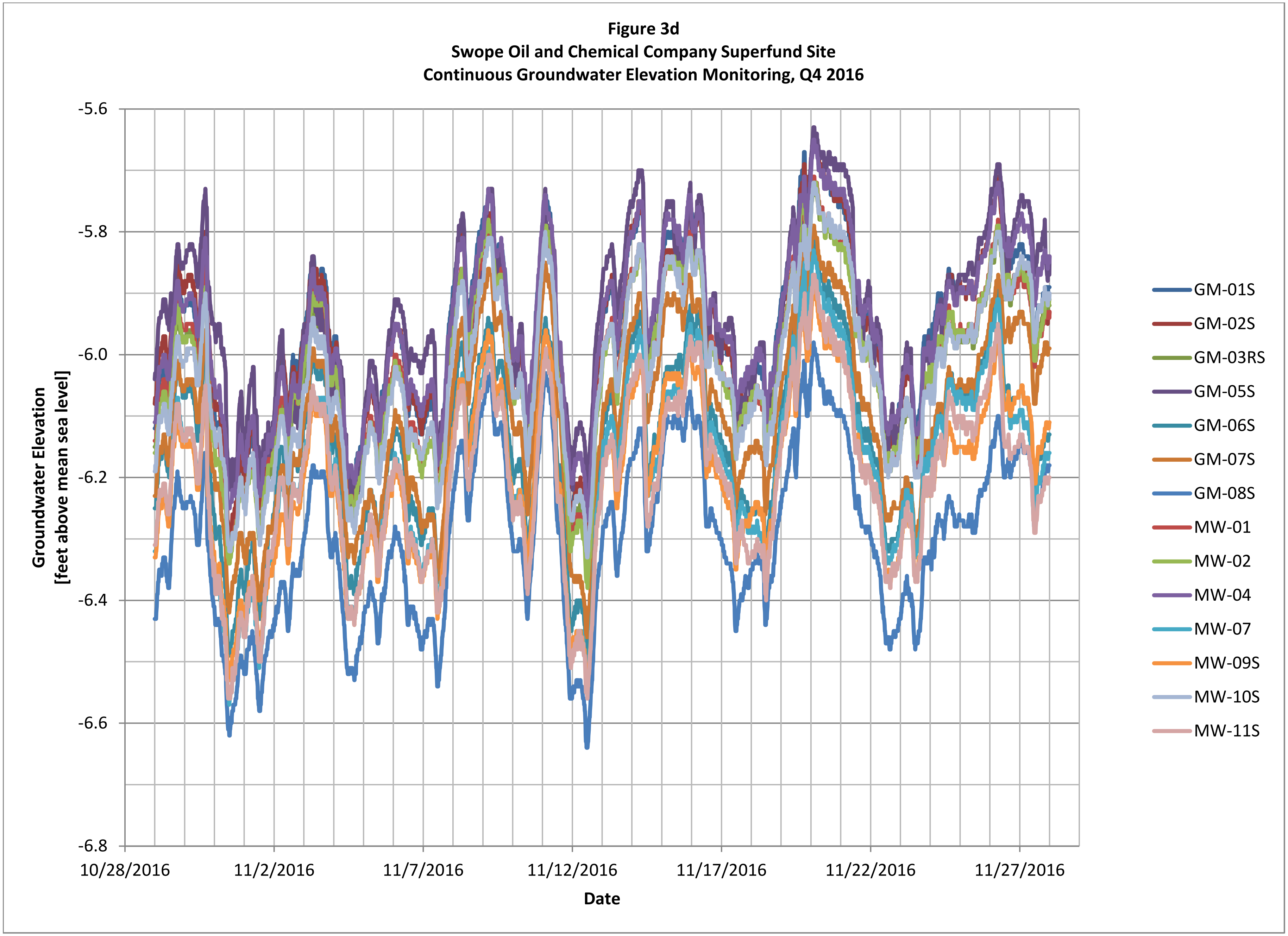
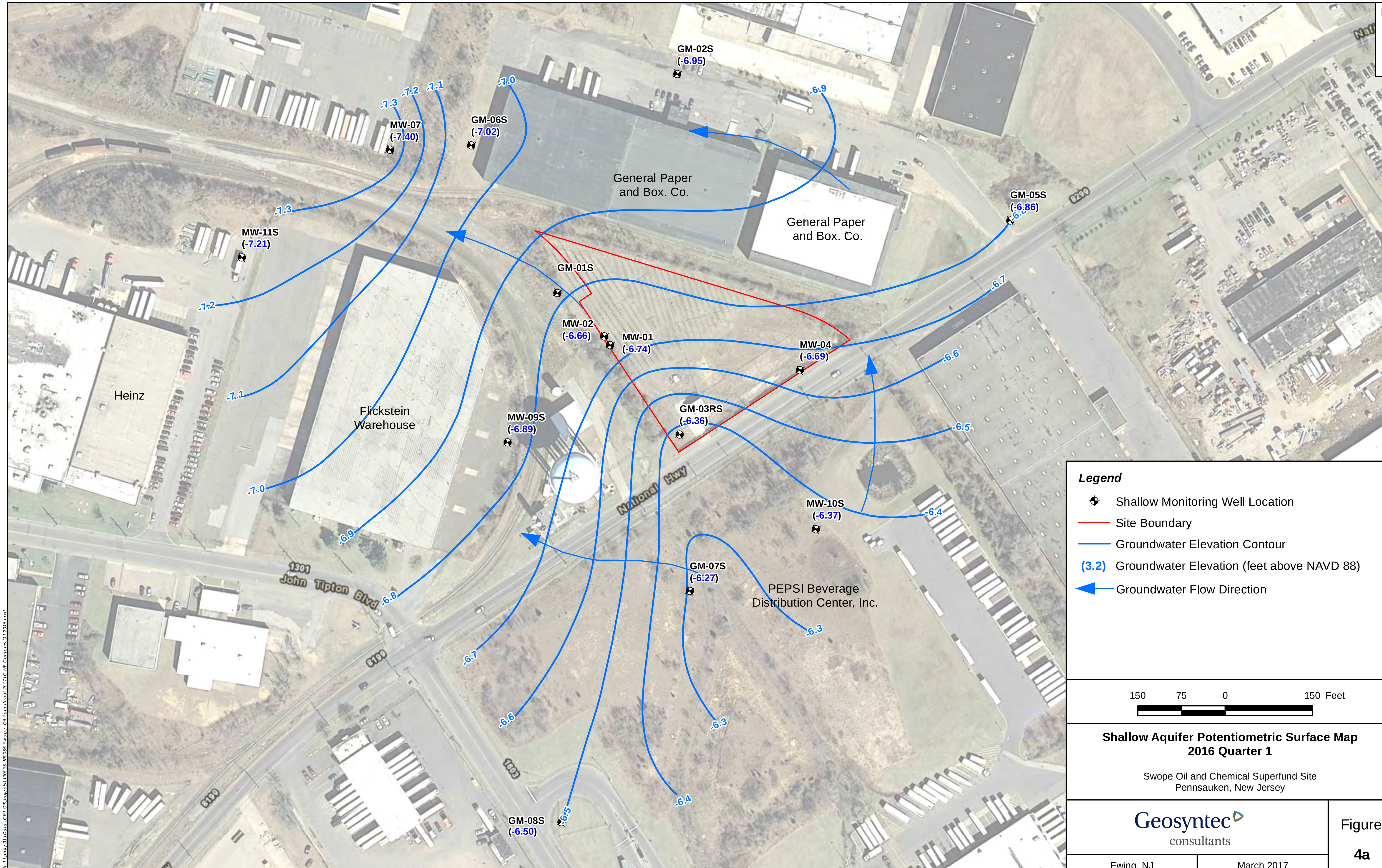


Figure 3d
Swope Oil and Chemical Company Superfund Site
Continuous Groundwater Elevation Monitoring, Q4 2016
Groundwater Elevation
[feet above mean sea level]
-5.6
-5.8
-6.0
-6.2
-6.4
-6.6
-6.8
10/28/2016
11/2/2016
11/7/2016
11/12/2016
11/17/2016
11/22/2016
11/27/2016
Date
GM-01S
GM-02S
GM-03RS
GM-05S
GM-06S
GM-07S
GM-08S
MW-01
MW-02
MW-04
MW-07
MW-09S
MW-10S
MW-11S



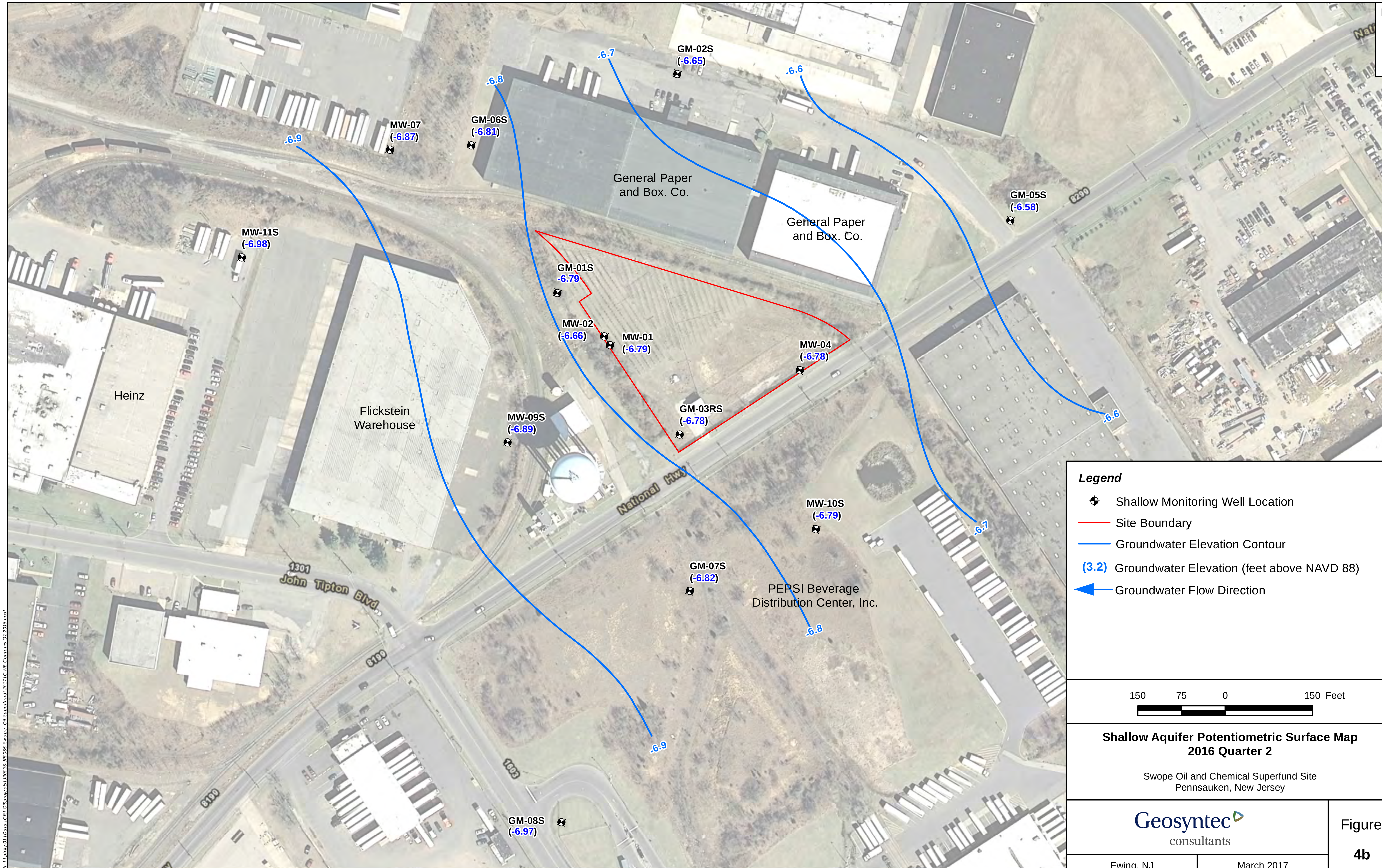
Shallow Aquifer Potentiometric Surface Map
2016 Quarter 1

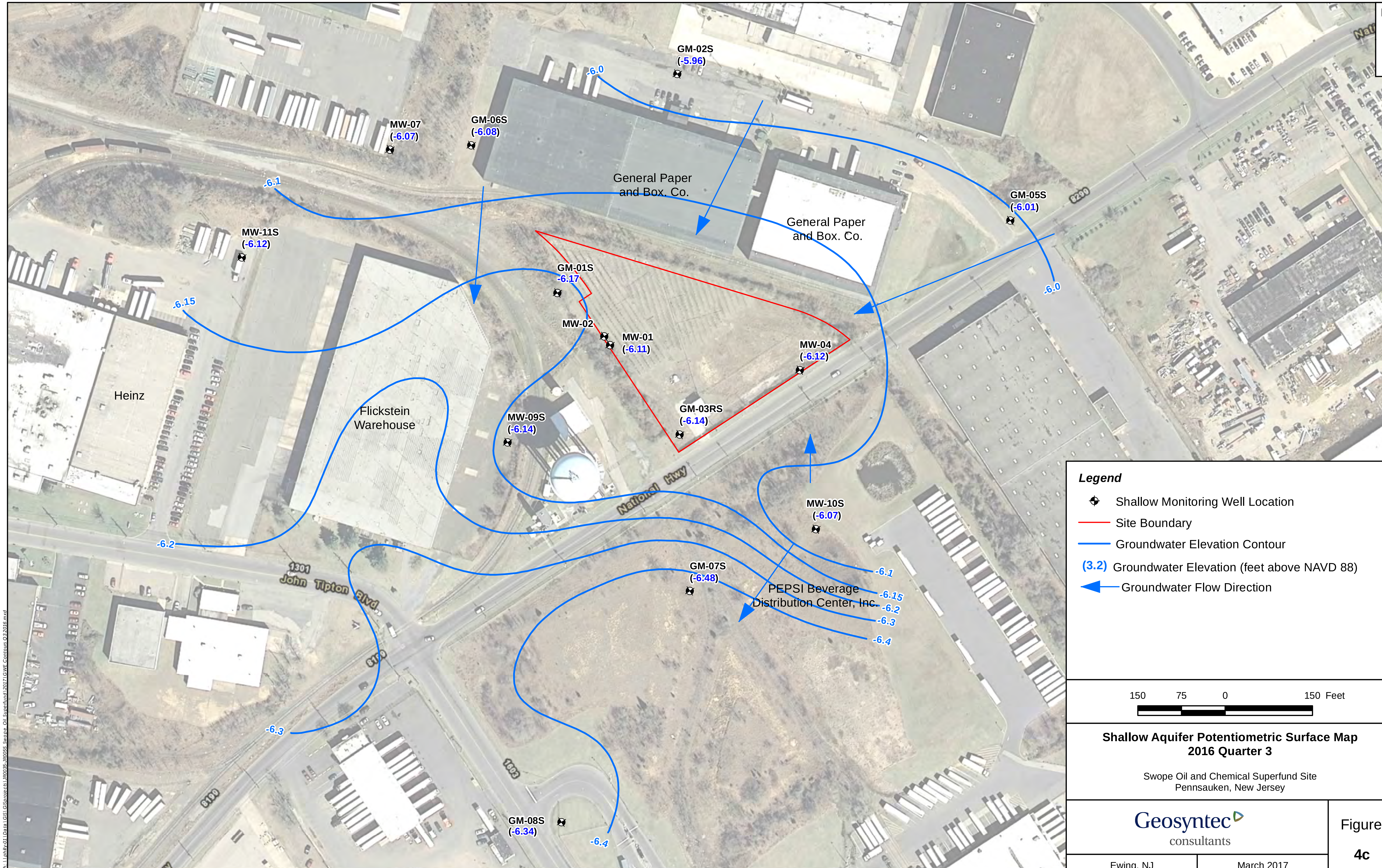
Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

Ewing, NJ | March 2017

Figure 4a


N
GM-02S
(-6.65)
-6.7
-6.6
-6.8
-6.9
MW-07
(-6.87)
GM-06S
(-6.81)
General Paper
and Box. Co.
General Paper
and Box. Co.
GM-05S
(-6.58)
MW-11S
(-6.98)
GM-01S
-6.79
MW-02
(-6.66)
MW-01
(-6.79)
MW-04
(-6.78)
Heinz
Flickstein
Warehouse
MW-09S
(-6.89)
GM-03RS
(-6.78)
-6.6
National Hwy
MW-10S
(-6.79)
-6.7
1301
John Tipton Blvd
GM-07S
(-6.82)
PEPSI Beverage
Distribution Center, Inc.
-6.8
-6.9
GM-08S
(-6.97)
Legend
Shallow Monitoring Well Location
Site Boundary
Groundwater Elevation Contour
(3.2) Groundwater Elevation (feet above NAVD 88)
Groundwater Flow Direction
150 75 0 150 Feet
Shallow Aquifer Potentiometric Surface Map
2016 Quarter 2
Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey
Geosyntec
consultants
Figure
4b
Ewing, NJ
March 2017



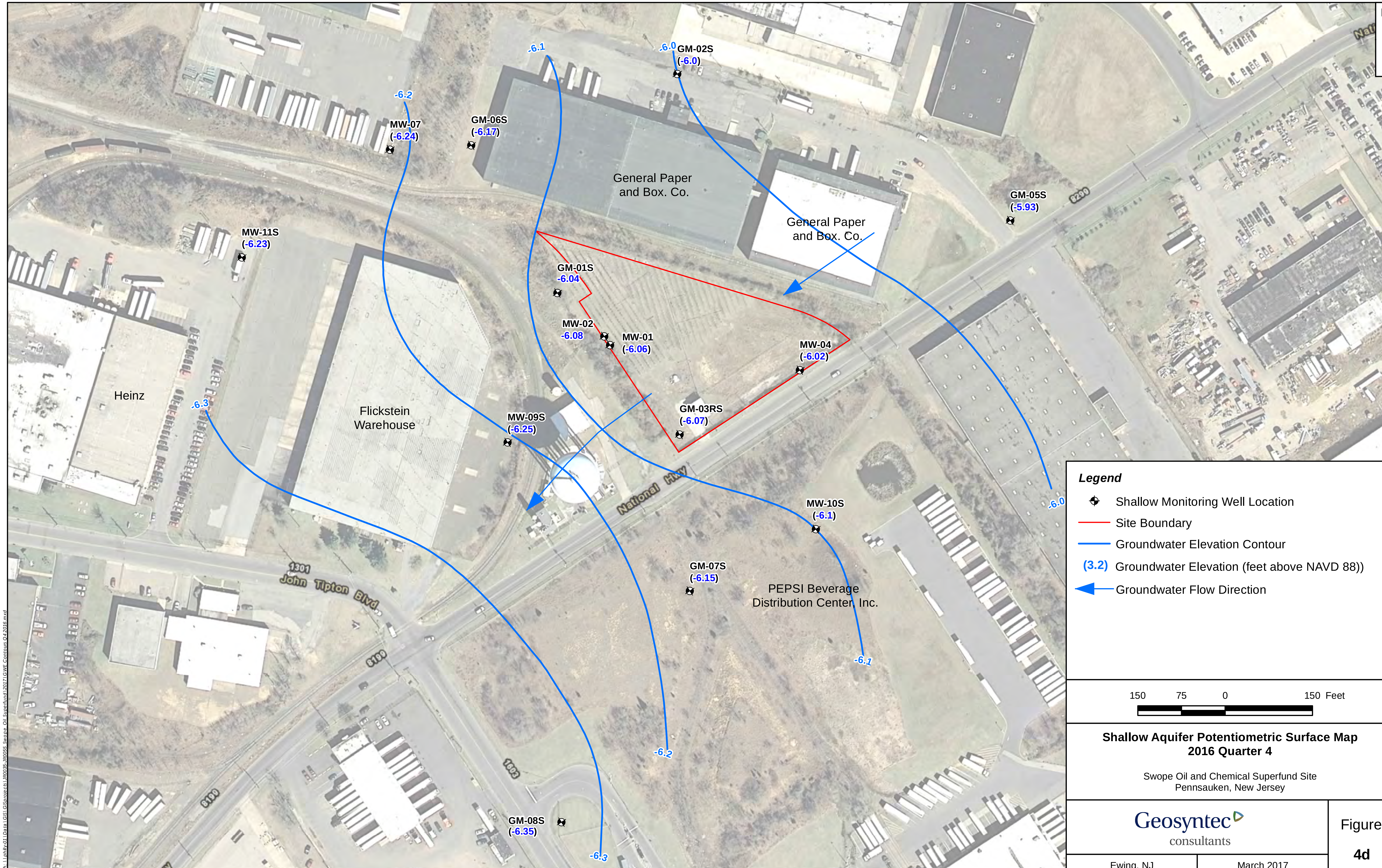
Shallow Aquifer Potentiometric Surface Map
2016 Quarter 3

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

Ewing, NJ | March 2017

Figure 4c


N
-6.1
-6.0
GM-02S
(-6.0)
-6.2
MW-07
(-6.24)
GM-06S
(-6.17)
General Paper
and Box. Co.
General Paper
and Box. Co.
GM-05S
(-5.93)
MW-11S
(-6.23)
GM-01S
-6.04
MW-02
-6.08
MW-01
(-6.06)
MW-04
(-6.02)
Heinz
-6.3
Flickstein
Warehouse
MW-09S
(-6.25)
GM-03RS
(-6.07)
National Hwy
MW-10S
(-6.1)
-6.0
GM-07S
(-6.15)
PEPSI Beverage
Distribution Center, Inc.
1301
John Tipton Blvd
-6.1
-6.2
GM-08S
(-6.35)
-6.3
Legend
Shallow Monitoring Well Location
Site Boundary
Groundwater Elevation Contour
(3.2) Groundwater Elevation (feet above NAVD 88))
Groundwater Flow Direction
150 75 0 150 Feet
Shallow Aquifer Potentiometric Surface Map
2016 Quarter 4
Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey
Geosyntec
consultants
Figure
4d
Ewing, NJ
March 2017

GM-01S				
Sample Date	3/23/2016	8/11/2016	10/19/2016	11/29/2016
Field Sample ID	GM-01S.20160323	GM-01S.20160811	GM-01S.20161019	GM-01S.20161129
Dissolved Gases				
Ethane	0.002 U	0.003 U	0.003 U	0.003 U
Ethene	0.004 U	0.0035 J	0.29	0.001 U
Methane	37	0.056 J	0.027 U	0.027 U
General Chemistry				
Alkalinity, Total	7,000	3,200	7,200	5000 U
Nitrate	950	1,800	2,000	2,200
Nitrate and Nitrite	960	1,800	2,000	2,200
Nitrite	5.5	0.01 U	10 U	10 U
Sulfate	10,800	7,500	10000 U	10000 U
Total Organic Carbon	1000 U	1 U	1000 U	1000 U
Total Suspended Solids (mg/L)	4 U	4 U	4 U	0.6
Metals				
Iron (Dissolved)	13.5	50 U	50 U	50 U
Iron (Total)	16.9	50 U	50 U	50 U
Manganese (Dissolved)	122	100	109	114
Manganese (Total)	122	101	109	120
VOCs				
1,4-Dioxane	0.11 U	0.1 U	0.177	0.181
cis-1,2-Dichloroethene	0.99 J	1.1	0.97 J	0.95 J
Tetrachloroethene	0.97 J	1.2	1.2	1.3 J
Trichloroethene	2.8	3.2	3	2.8 J
Vinyl Chloride	1 U	1 U	1 U	1 U

MW-07				
Sample Date	3/23/2016	8/10/2016	10/19/2016	11/30/2016
Field Sample ID	MW-07.20160323	MW-07.20160810	MW-07.20161019	MW-07.20161130
Dissolved Gases				
Ethane	0.002 U	0.003 J	0.003 J	0.003 U
Ethene	0.004 U	0.001 U	0.001 J	0.001 U
Methane	8.8	0.027 U	0.027 J	0.027 U
General Chemistry				
Alkalinity, Total	10000 U	5 U	5000 U	5000 U
Nitrate	2,300	2,600	2,600	2,200
Nitrate and Nitrite	2,300	2,600	2,600	2,200
Nitrite	10 U	0.01 U	10 U	10 U
Sulfate	1,600	2,000	10000 U	2,500
Total Organic Carbon	1000 U	1 U	1000 U	1000 U
Total Suspended Solids (mg/L)	1.4	0.6	3.8	1
Metals				
Iron (Dissolved)	50 U	3.8	50 U	5.2
Iron (Total)	27	31.8	59	16.4
Manganese (Dissolved)	53.4	51.2	52.2	65.1
Manganese (Total)	61.4	54.1	58.8	71
VOCs				
1,4-Dioxane	0.11 U	0.1 U	0.1 U	0.1 U
cis-1,2-Dichloroethene	2.4	2.8	2.3	2
Tetrachloroethene	0.52 J	0.56 J	0.39 J	0.61 J
Trichloroethene	3.5	3.7	3.6	3.5
Vinyl Chloride	1 U	1 U	1 U	1 U

GM-06S					
Sample Date	3/24/2016	8/9/2016	8/9/2016	10/18/2016	11/30/2016
Field Sample ID	GM-06S.20160324	DUP-01.20160809	GM-06S.20160809	GM-06S.20161018	GM-06S.20161130
Dissolved Gases					
Ethane	0.002 U	0.003 U	0.003 U	0.007 U	0.11
Ethene	0.004 U	0.001 U	0.001 U	0.009 U	0.001 U
Methane	1.3	0.027 U	0.027 U	3.8	5
General Chemistry					
Alkalinity, Total	21,000	11,300	10,800	20,600	15,100
Nitrate	1,600	2,800	2,700	840	700
Nitrate and Nitrite	1,600	2,800	2,700	840	700
Nitrite	11	0.01 U	0.01 U	10 U	10 U
Sulfate	25,800	21,200	21,200	42,300	44,000
Total Organic Carbon	1000	370	340	330	1000
Total Suspended Solids (mg/L)	4 U	4 U	4 U	4 U	4 U
Metals (µg/L)					
Iron (Dissolved)	50 U	50 U	50 U	50 U	50 U
Iron (Total)	6.4	50 U	50 U	50 U	50 U
Manganese (Dissolved)	689	683	707	1,300	1,460
Manganese (Total)	682	769	768	1,360	1,430
VOCs (µg/L)					
1,4-Dioxane	0.258	0.203	0.212	0.425	0.788
cis-1,2-Dichloroethene	3.5	2.5	2.5	7.4	9.5
Tetrachloroethene	0.65 J	1.2 J	0.93	0.82 J	1.1
Trichloroethene	1.1	1.6	1.7	1.8	2.2
Vinyl Chloride	1 U	1 U	1 U	0.56 J	0.79 J

GM-02S				
Sample Date	3/24/2016	8/9/2016	10/18/2016	11/30/2016
Field Sample ID	GM-02S.20160324	GM-02S.20160809	GM-02S.20161018	GM-02S.20161130
Dissolved Gases	ND	NDE	NDE	NDE
Ethane	0.002 U	0.003 U	0.007 U	0.003 U
Ethene	0.004 U	0.001 U	0.009 U	0.001 U
Methane	0.037 U	5.9 J	15	8
General Chemistry				
Alkalinity, Total	21,000	19,400	31,200	37,400
Nitrate	1,800	1,300	810	1,100
Nitrate and Nitrite	1,800	1,300	810	1,100
Nitrite	13	0.01 U	10 U	10 U
Sulfate	26,300	37,000	37,700	36,900
Total Organic Carbon	1,100	900	1,100	1,200
Total Suspended Solids (mg/L)	4 U	4 U	4 U	4.9
Metals (µg/L)				
Iron (Dissolved)	50 U	50 U	50 U	50 U
Iron (Total)	9.6	50 U	50 U	503
Manganese (Dissolved)	327	574	1,050	855
Manganese (Total)	334	540	1,080	860
VOCs (µg/L)				
1,4-Dioxane	0.369	0.502	0.743	0.914
cis-1,2-Dichloroethene	8.9	13.1	19	20.8
Tetrachloroethene	1.7	2.7	3.4	3.6
Trichloroethene	3.1	**5.5**	**7.7**	**7.5**
Vinyl Chloride	0.34 J	0.53 J	0.99 J	1.1

GM-05S				
Sample Date	3/24/2016	8/9/2016	10/18/2016	11/30/2016
Field Sample ID	GM-05S.20160324	GM-05S.20160809	GM-05S.20161018	GM-05S.20161130
Dissolved Gases				
Ethane	0.002 U	0.003 U	0.007 U	0.003 U
Ethene	0.004 U	0.001 U	0.009 U	0.001 U
Methane	0.037 U	0.027 U	0.027 U	0.027 U
General Chemistry				
Alkalinity, Total	13,100	5 U	3,300	2,200
Nitrate	2,500	2,500	2,500	2,200
Nitrate and Nitrite	2,500	2,500	2,500	2,200
Nitrite	12	0.01 U	10 U	10 U
Sulfate	23,800	22,500	29,200	33,500
Total Organic Carbon	1000 U	410	300	1000
Total Suspended Solids (mg/L)	4 U	4 U	4 U	4 U
Metals (µg/L)				
Iron (Dissolved)	50 U	50 U	50 U	50 U
Iron (Total)	5	50 U	50 U	50 U
Manganese (Dissolved)	81.7	126	150	144
Manganese (Total)	81.9	128	146	125
VOCs (µg/L)				
1,4-Dioxane	0.329	0.43	0.38	0.548
cis-1,2-Dichloroethene	8.6	7.7	7.2	9
Tetrachloroethene	2.8	3.7	2.6	3
Trichloroethene	4.9	**5.3**	5	**5.3**
Vinyl Chloride	1 U	1 U	1 U	1 U

MW-04				
Sample Date	3/23/2016	8/9/2016	10/19/2016	11/29/2016
Field Sample ID	MW-04.20160323	MW-04.20160809	MW-04.20161019	MW-04.20161129
Dissolved Gases				
Ethane	0.002 U	0.003 U	0.26	0.003 U
Ethene	0.004 U	0.001 U	0.14	0.001 U
Methane	0.037 U	0.027 U	1.4	0.027 U
General Chemistry				
Alkalinity, Total	10,000	3,800	7,200	5000 U
Nitrate	3,200	3,900	3,700	3,500
Nitrate and Nitrite	3,200	3,900	3,700	3,500
Nitrite	10 U	10 U	10 U	10 U
Sulfate	12,500	11,300	13,600	12,800
Total Organic Carbon	1000 U	350	310	1000 U
Total Suspended Solids (mg/L)	4 U	4 U	4 U	1.3
Metals (µg/L)				
Iron (Dissolved)	50 U	50 U	50 U	50 U
Iron (Total)	50 U	50 U	50 U	50 U
Manganese (Dissolved)	51.9	60.8	58	66.3
Manganese (Total)	59.7	63	59.6	71.5
VOCs (µg/L)				
1,4-Dioxane	0.7	0.502	0.42	0.354
cis-1,2-Dichloroethene	10.5	9.2	11.3	13.5
Tetrachloroethene	0.84 J	1.2	1.1	1.2
Trichloroethene	**48.2**	**54.1**	**56.1**	**62.1**
Vinyl Chloride	1 U	1 U	1 U	1 U

GM-03RS				
Sample Date	3/24/2016	8/9/2016	10/20/2016	11/29/2016
Field Sample ID	GM-03RS.20160324	GM-03RS.20160809	GM-03RS.20161020	GM-03RS.20161129
Dissolved Gases	NDE	NDE	NDE	NDE
Ethane	0.002 U	0.003 U	0.003 J	0.003 U
Ethene	0.004 U	0.001 U	0.001 J	0.001 U
Methane	7.6	22 J	4.7	2.6
General Chemistry				
Alkalinity, Total	10,500	5 U	5000 U	5000 U
Nitrate	330	150	570	540
Nitrate and Nitrite	340	160	570	540
Nitrite	13	7.1	10 U	10 U
Sulfate	11,600	12,500	13,600	14,300
Total Organic Carbon	1000 U	400	1000 U	1000 U
Total Suspended Solids (mg/L)	4 U	4 U	4 U	1
Metals (µg/L)				
Iron (Dissolved)	78.9	50 U	58	50 U
Iron (Total)	109	135	86.9	200
Manganese (Dissolved)	492	488	441	482
Manganese (Total)	496	523	470	457
VOCs (µg/L)				
1,4-Dioxane	3.22	4.51	2.56	2.45
cis-1,2-Dichloroethene	14.3	14.7	13.9	14.2
Tetrachloroethene	2	2.4	2.3	2.3
Trichloroethene	**19.8**	**19.2**	**22.8**	**23.5**
Vinyl Chloride	0.29 J	0.22 J	1 U	1 U

MW-10S				
Sample Date	3/23/2016	8/10/2016	10/19/2016	12/1/2016
Field Sample ID	MW-10S.20160323	MW-10S.20160810	MW-10S.20161019	MW-10S.20161201
Dissolved Gases				
Ethane	0.002 U	0.007 U	0.003 J	0.003 U
Ethene	0.004 U	0.03 J	0.11	0.11
Methane	0.037 U	0.027 U	0.027 J	0.027 U
General Chemistry				
Alkalinity, Total	4,500	5 U	5000 U	5000 U
Nitrate	1,600	1,300	1,800	1,900
Nitrate and Nitrite	1,600	1,300	1,800	1,900
Nitrite	10 U	0.01 U	10 U	10 U
Sulfate	17,700	18,500	25,100	21,200
Total Organic Carbon	1000 U	1 U	1000 U	460
Total Suspended Solids (mg/L)	4 U	4 U	4 U	4 U
Metals (µg/L)				
Iron (Dissolved)	50 U	50 U	50 U	50 U
Iron (Total)	50 U	50 U	50 U	50 U
Manganese (Dissolved)	260	540	267	228
Manganese (Total)	262	567	228	228
VOCs (µg/L)				
1,4-Dioxane	5.77	3.64	3.37	3.89
cis-1,2-Dichloroethene	28.1	11.9	23	35.1
Tetrachloroethene	3.5	1.1	5	4.5
Trichloroethene	**109**	**40.2**	**93.5**	**132**
Vinyl Chloride	1 U	1 U	1 U	1 U

MW-11S							
Sample Date	3/22/2016	3/22/2016	8/11/2016	10/18/2016	10/18/2016	11/30/2016	11/30/2016
Field Sample ID	DUP01.20160322	MW-11S.20160322	MW-11S.20160811	DUP-01.20161018	MW-11S.20161018	DUP-01.20161130	MW-11S.20161130
Dissolved Gases							
Ethane	0.002 U	0.002 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U
Ethene	0.004 U	0.004 U	0.092 J	0.001 U	0.001 U	0.001 U	0.001 U
Methane	0.037 U	0.037 U	0.1 J	0.027 U	0.027 U	0.027 U	0.027 U
General Chemistry							
Alkalinity, Total	5000 U	5000 U	4,300	5000 U	5000 U	5000 U	5000 U
Nitrate	1,400	1,400	1,900	1,900	1,900	1,600	1,700
Nitrate and Nitrite	1,400	1,400	1,900	1,900	1,900	1,600	1,700
Nitrite	10 U	10 U	0.01 U	10 U	10 U	10 U	10 U
Sulfate	3,600	3,500	4,200	6,500	4,500	3,800	3,800
Total Organic Carbon	1000 U	1000 U	1 U	1000 U	1000 U	1000 U	1000 U
Total Suspended Solids (mg/L)	4 U	4 U	4 U	4 U	4 U	4	0.7 J
Metals (µg/L)							
Iron (Dissolved)	50 U	50 U	50 U	50	50 U	50 U	2.7
Iron (Total)	50 U	50 U	50 U	50 U	50 U	50 U	11.7
Manganese (Dissolved)	18	16.9	20.7	22.4	23.2	37.9	38.9
Manganese (Total)	27.5	28.1	26.3	23.3	23.2	41.6	41.5
VOCs (µg/L)							
1,4-Dioxane	0.1	1.29 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
cis-1,2-Dichloroethene	5.2	5.2	6.7	4.2	4.5	3.1	3.4
Tetrachloroethene	2.1	2	1.9	1.6	1.6	1.4	1.4
Trichloroethene	**8.5**	**8.3**	**9.6**	**7.7**	**7.9**	**7**	**7.1**
Vinyl Chloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U

MW-02				
Sample Date	3/23/2016	8/10/2016	10/19/2016	11/29/2016
Field Sample ID	MW-02.20160323	MW-02.20160810	MW-02.20161019	MW-02.20161129
Dissolved Gases				
Ethane	0.002 U	0.003 U	0.003 U	0.16
Ethene	0.004 U	0.001 U	0.001 U	0.001 U
Methane	200	240	290	230
General Chemistry				
Alkalinity, Total	22,500	9,700	29,000	7,800
Nitrate	110 U	68	71	190
Nitrate and Nitrite	100 U	68	100 U	190
Nitrite	10 U	0.01 U	10 U	10 U
Sulfate	35,400	38,600	46,900	45,700
Total Organic Carbon	1,400	1,200	790	1,600
Total Suspended Solids (mg/L)	4 U	1	4 U	0.8
Metals (µg/L)				
Iron (Dissolved)	2,280	4,240	3,940	2,850
Iron (Total)	2,230	4,270	3,820	3,010
Manganese (Dissolved)	787	1,170	1,260	1,190
Manganese (Total)	812	1,100	1,180	1,130
VOCs (µg/L)				
1,4-Dioxane	47.6	38.4	45.6	44.9
cis-1,2-Dichloroethene	9.1	10.8	9.8	11.3
Tetrachloroethene	2.3	2.2	2	2.3
Trichloroethene	**9.6**	**10.6**	**10.5**	**13.2**
Vinyl Chloride	1 U	0.47 J	1 U	0.44 J

MW-01				
Sample Date	3/23/2016	8/10/2016	10/19/2016	11/29/2016
Field Sample ID	MW-01.20160323	MW-01.20160810	MW-01.20161019	MW-01.20161129
Dissolved Gases				
Ethane	0.002 U	0.003 U	0.003 J	0.003 U
Ethene	0.004 U	0.001 U	0.001 J	0.001 U
Methane	11	16	8.6	5.3
General Chemistry				
Alkalinity, Total	26,000	30,200	29,000	21,700
Nitrate	540	830	1000	1,100
Nitrate and Nitrite	540	830	1000	1,100
Nitrite	10 U	0.01 U	10 U	10 U
Sulfate	13,400	14,600	18,000	16,500
Total Organic Carbon	1000 U	1 U	1000 U	1000 U
Total Suspended Solids (mg/L)	4 U	4 U	4 U	4 U
Metals (µg/L)				
Iron (Dissolved)	4	50 U	50 U	50 U
Iron (Total)	4.3	50 U	50 U	50 U
Manganese (Dissolved)	418	368	326	318
Manganese (Total)	407	344	331	322
VOCs (µg/L)				
1,4-Dioxane	1.17	1.36	0.864	0.968
cis-1,2-Dichloroethene	2.6	2.9	4.2	3.7
Tetrachloroethene	1.7	1.6	1.7	1.6
Trichloroethene	2.1	3	3.5	3.4
Vinyl Chloride	1 U	1 U	1 U	1 U

MW-09S				
Sample Date	3/22/2016	8/11/2016	10/18/2016	11/30/2016
Field Sample ID	MW-09S.20160322	MW-09S.20160811	MW-09S.20161018	MW-09S.20161130
Dissolved Gases				
Ethane	0.002 U	0.028 J	0.003 U	0.003 U
Ethene	0.004 U	0.36	0.001 U	0.15
Methane	38	100	24	14
General Chemistry				
Alkalinity, Total	42,500	51,800	34,000	24,500
Nitrate	180	0.11 U	370	380
Nitrate and Nitrite	180	0.1 U	370	380
Nitrite	10 U	0.01 U	10 U	10 U
Sulfate	16,000	25,200	19,400	20,300
Total Organic Carbon	1000 U	1 U	450	1000 U
Total Suspended Solids (mg/L)	4.4	4 U	6.8	3.2
Metals (µg/L)				
Iron (Dissolved)	14,300	27,400	12,100	7,510
Iron (Total)	14,300	27,700	12,500	7,500
Manganese (Dissolved)	233	570	249	290
Manganese (Total)	231	568	253	288
VOCs (µg/L)				
1,4-Dioxane	3.76 J	23.4	3.96	3.92
cis-1,2-Dichloroethene	5.5	12.5	5.3	5.3
Tetrachloroethene	1.6	2.2	1.5	1.5
Trichloroethene	**5.9**	**9.4**	4.9	**5.3**
Vinyl Chloride	0.34 J	1.8	1 U	0.33 J

GM-08S				
Sample Date	3/24/2016	8/10/2016	10/20/2016	12/1/2016
Field Sample ID	GM-08S.20160324	GM-08S.20160810	GM-08S.20161020	GM-08S.20161201
Dissolved Gases				
Ethane	0.002 U	0.003 U	0.003 J	0.003 U
Ethene	0.004 U	0.001 U	0.47	0.62
Methane	31	10	43	55
General Chemistry				
Alkalinity, Total	22,100	15,100	24,500	13,900
Nitrate	110 U	68	330	110 U
Nitrate and Nitrite	100 U	68	330	100 U
Nitrite	12	0.01 U	10 U	10 U
Sulfate	11,300	9,400	16,000	18,300
Total Organic Carbon	1000 U	1 U	1000 U	510
Total Suspended Solids (mg/L)	4 U	2	4 U	1.8
Metals (µg/L)				
Iron (Dissolved)	8,880	5,920	12,600	12,100
Iron (Total)	8,620	5,900	12,700	12,000
Manganese (Dissolved)	707	544	671	787
Manganese (Total)	678	547	694	759
VOCs (µg/L)				
1,4-Dioxane	3.82	2.44	3.48	4.74
cis-1,2-Dichloroethene	0.73 J	1	0.75 J	0.97 J
Tetrachloroethene	1 U	1 U	1 U	1 U
Trichloroethene	0.61 J	0.5 J	1.1	1.3 J
Vinyl Chloride	1 U	1 U	0.74 J	0.84 J

GM-07S				
Sample Date	3/24/2016	8/10/2016	10/20/2016	12/1/2016
Field Sample ID	GM-07S.20160324	GM-07S.20160810	GM-07S.20161020	GM-07S.20161201
Dissolved Gases				
Ethane	0.002 U	0.0072 J	0.003 J	0.003 U
Ethene	0.004 U	0.018 J	0.001 J	0.001 U
Methane	2.7	3	6.6	8.7
General Chemistry				
Alkalinity, Total	5000 U	5 U	5000 U	5000 U
Nitrate	930	1,100	1,100	820
Nitrate and Nitrite	940	1,100	1,100	820
Nitrite	13	0.01 U	10 U	10 U
Sulfate	2,200	20,000	24,800	23,400
Total Organic Carbon	1000 U	1 U	1000 U	430
Total Suspended Solids (mg/L)	2.3	1.2	4 U	0.6
Metals (µg/L)				
Iron (Dissolved)	109	119	50 U	50 U
Iron (Total)	242	266	111	126
Manganese (Dissolved)	2,970	2,610	2,600	2,230
Manganese (Total)	3,040	2,680	2,430	2,210
VOCs (µg/L)				
1,4-Dioxane	2.65	2.7	1.77	2.98
cis-1,2-Dichloroethene	9.3	6.8	6.9	7.6
Tetrachloroethene	0.87 J	0.81 j	0.83 j	0.81 j
Trichloroethene	**8.7**	**7.9**	**9.8**	**13.2**
Vinyl Chloride	1 U	1 U	1 U	1 U

Legend

Monitoring Well Locations

Site Boundary

Groundwater Data Notes:

- Value exceeds the NJ Class IIA Groundwater Quality Standards.

Concentrations which exceed the NJ GWQS and US EPA GW MCLs are highlighted blue and **bolded**

U - Non-detectable
J - Estimated value

Note:
-Constituents of Concern are Trichloroethene, Tetrachloroethene & cis-1,2-Dichloroethene.
-All units are in µg/L, unless otherwise noted.

150 75 0 150 Feet

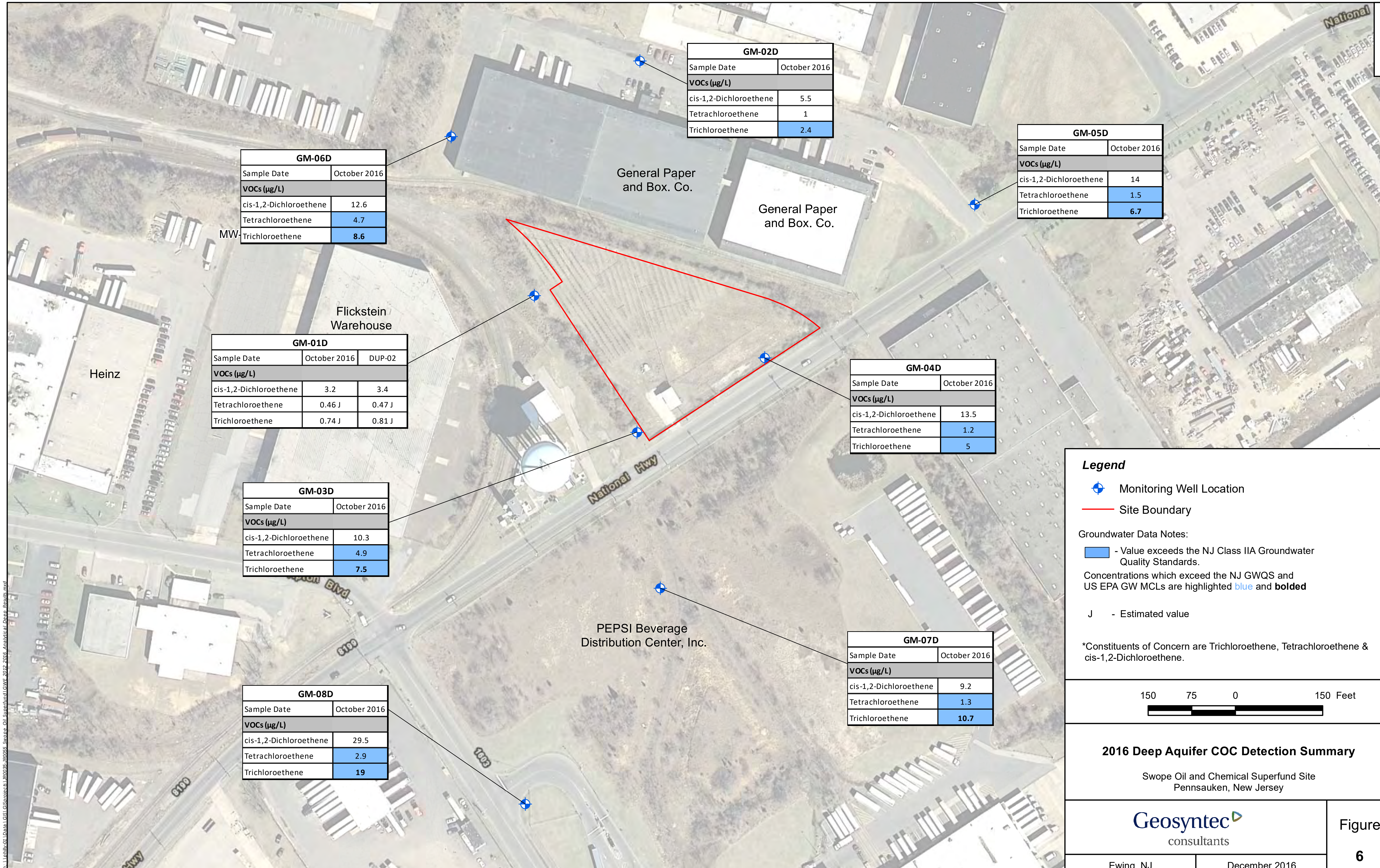
2016 Shallow Aquifer Biogeochemical Results and COC Detection Summary

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

Ewing, NJ | December 2016

Figure 5



GM-02D

Sample Date	October 2016
VOCs (µg/L)	
cis-1,2-Dichloroethene	5.5
Tetrachloroethene	1
Trichloroethene	2.4

GM-05D

Sample Date	October 2016
VOCs (µg/L)	
cis-1,2-Dichloroethene	14
Tetrachloroethene	1.5
Trichloroethene	6.7

GM-06D

Sample Date	October 2016
VOCs (µg/L)	
cis-1,2-Dichloroethene	12.6
Tetrachloroethene	4.7
Trichloroethene	8.6

GM-01D

Sample Date	October 2016	DUP-02
VOCs (µg/L)		
cis-1,2-Dichloroethene	3.2	3.4
Tetrachloroethene	0.46 J	0.47 J
Trichloroethene	0.74 J	0.81 J

GM-04D

Sample Date	October 2016
VOCs (µg/L)	
cis-1,2-Dichloroethene	13.5
Tetrachloroethene	1.2
Trichloroethene	5

GM-03D

Sample Date	October 2016
VOCs (µg/L)	
cis-1,2-Dichloroethene	10.3
Tetrachloroethene	4.9
Trichloroethene	**7.5**

GM-07D

Sample Date	October 2016
VOCs (µg/L)	
cis-1,2-Dichloroethene	9.2
Tetrachloroethene	1.3
Trichloroethene	**10.7**

GM-08D

Sample Date	October 2016
VOCs (µg/L)	
cis-1,2-Dichloroethene	29.5
Tetrachloroethene	2.9
Trichloroethene	**19**

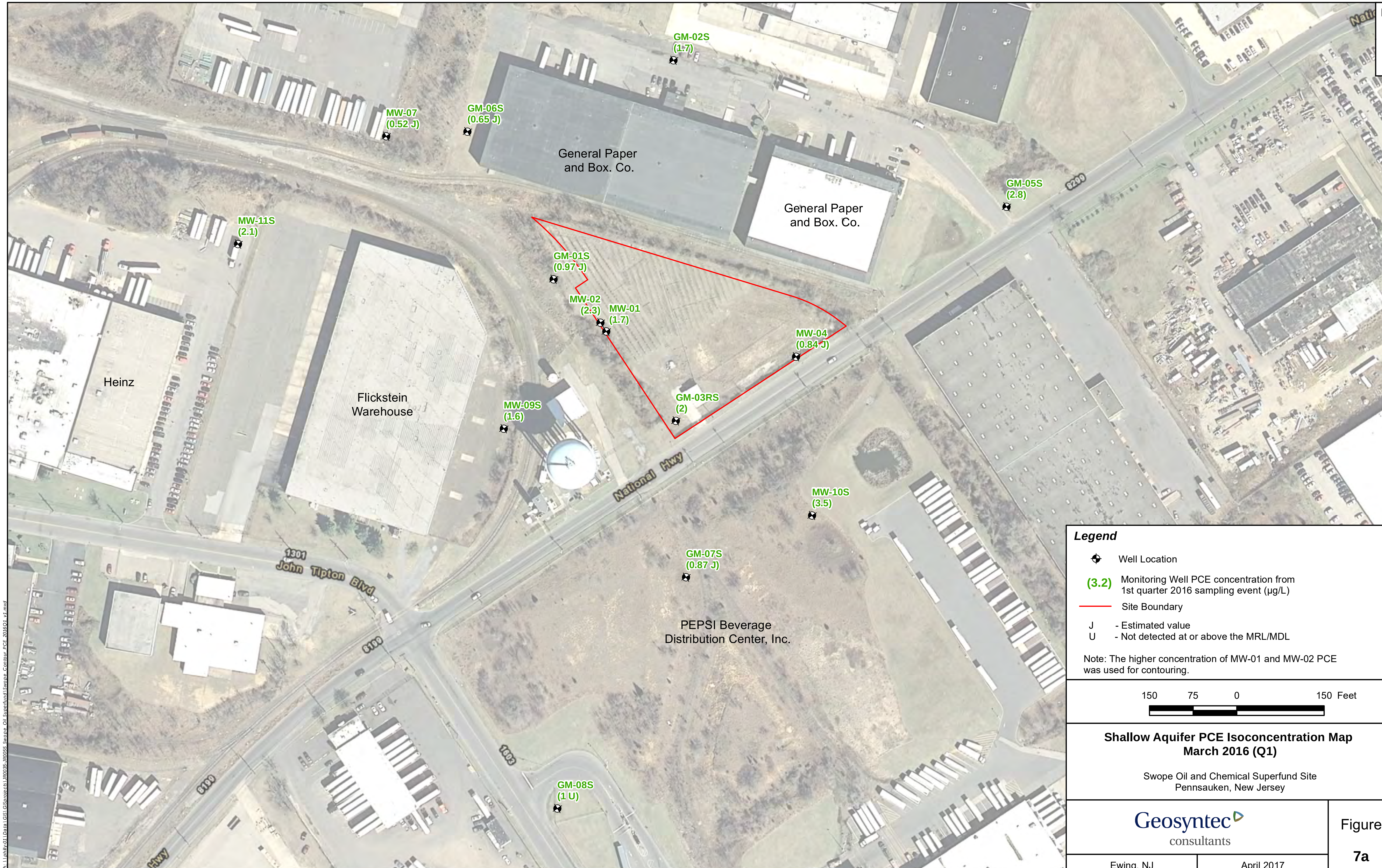
2016 Deep Aquifer COC Detection Summary

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

Ewing, NJ | December 2016

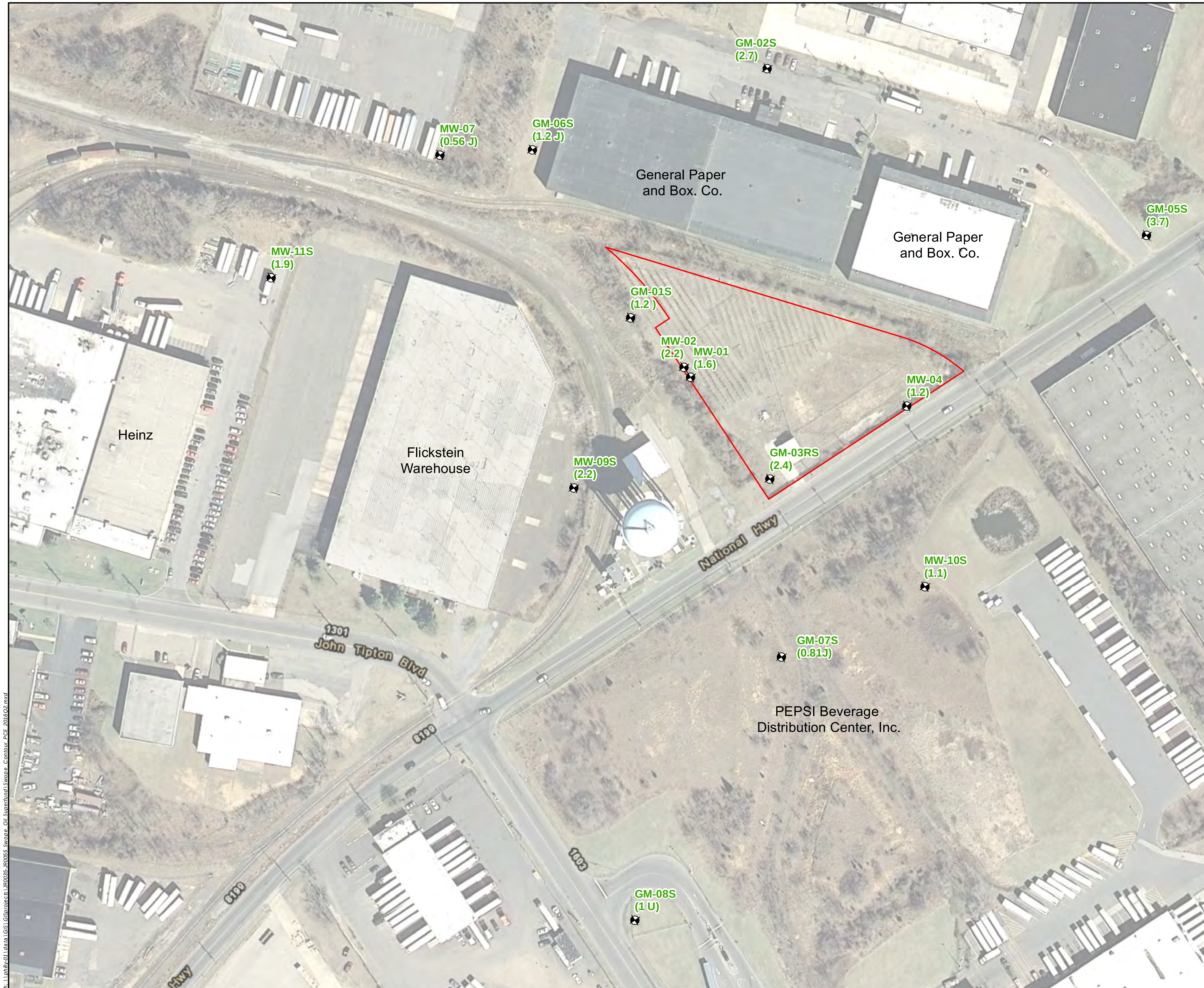
Figure 6



Shallow Aquifer PCE Isoconcentration Map
March 2016 (Q1)

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Figure 7a



Legend

Well Location

(3.2) Monitoring Well PCE concentration from 2nd quarter 2016 sampling event (µg/L)

Site Boundary

J - Estimated value

U - Not detected at or above the MRL/MDL

Note: The higher concentration of MW-01 and MW-02 PCE was used for contouring.

150 75 0 150 Feet

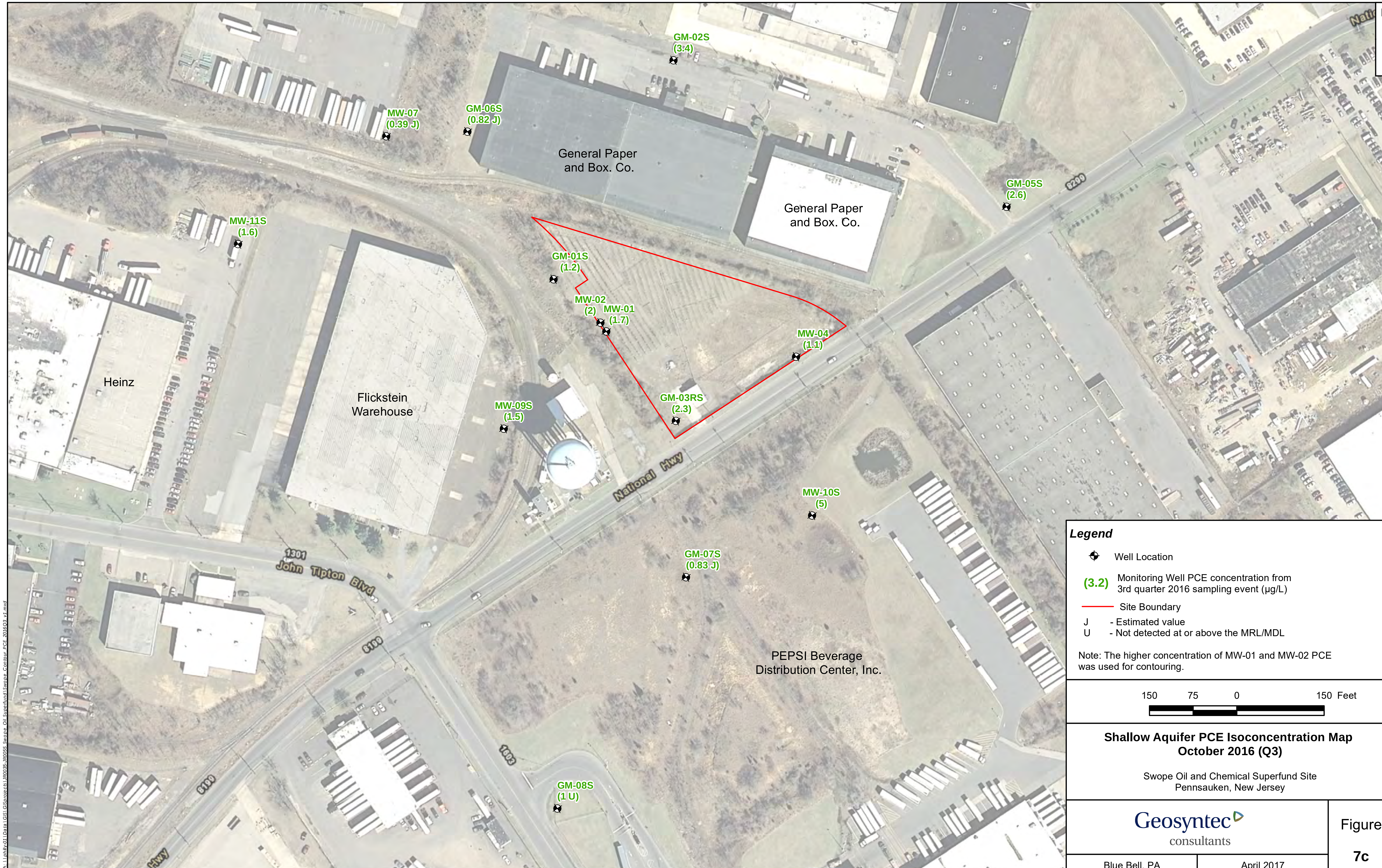
Shallow Aquifer PCE Isoconcentration Map
August 2016 (Q2)

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

Ewing, NJ | April 2017

Figure **7b**



Legend

Well Location

(3.2) Monitoring Well PCE concentration from 3rd quarter 2016 sampling event (µg/L)

Site Boundary

J - Estimated value

U - Not detected at or above the MRL/MDL

Note: The higher concentration of MW-01 and MW-02 PCE was used for contouring.

150 75 0 150 Feet

Shallow Aquifer PCE Isoconcentration Map
October 2016 (Q3)

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

Blue Bell, PA | April 2017

Figure **7c**

Legend

Well Location

(3.2) Monitoring Well PCE concentration from 4th quarter 2016 sampling event (µg/L)

Site Boundary

J - Estimated value
U - Not detected at or above the MRL/MDL

Note: The higher concentration of MW-01 and MW-02 PCE was used for contouring.

150 75 0 150 Feet

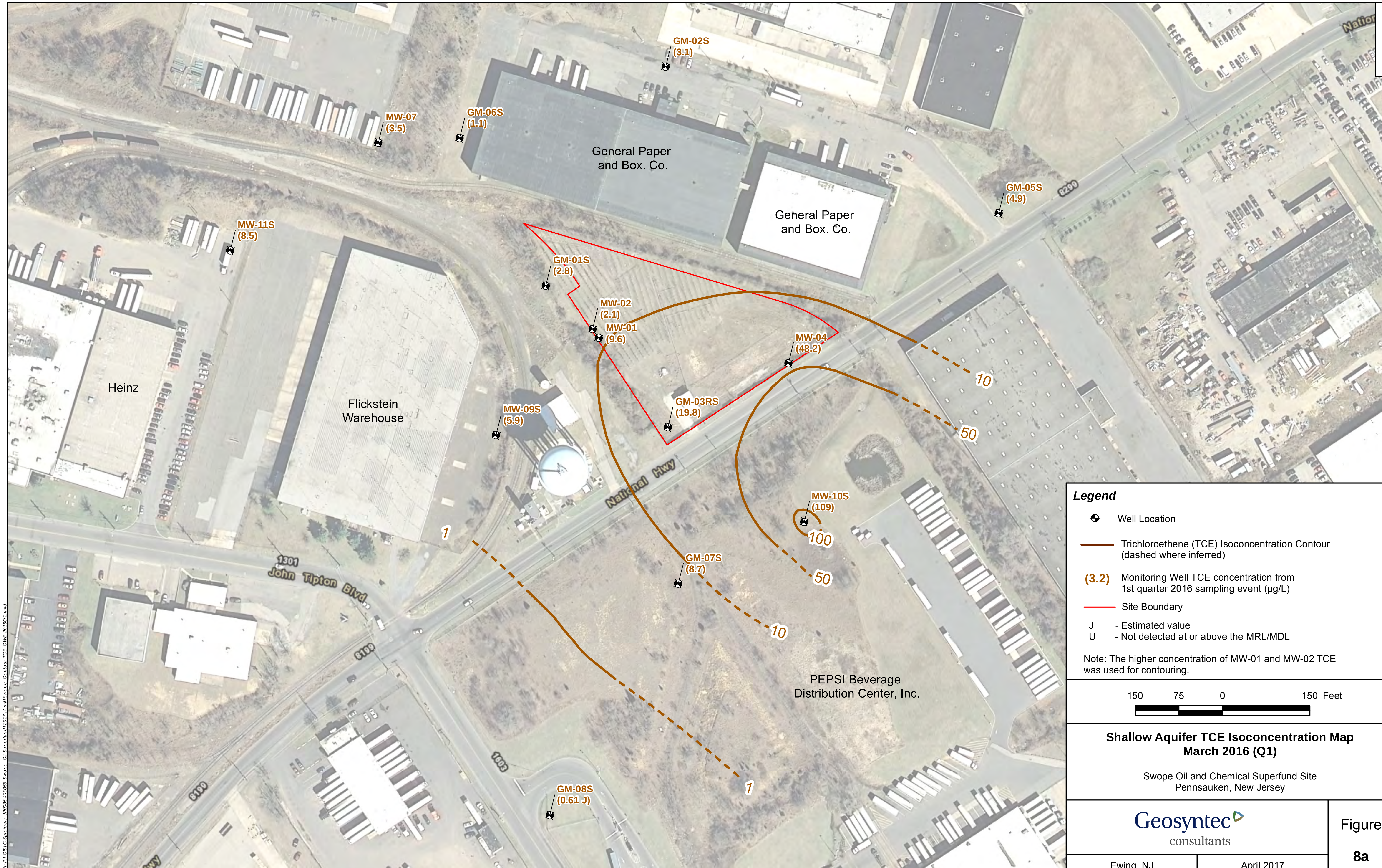
Shallow Aquifer PCE Isoconcentration Map
November/December 2016 (Q4)

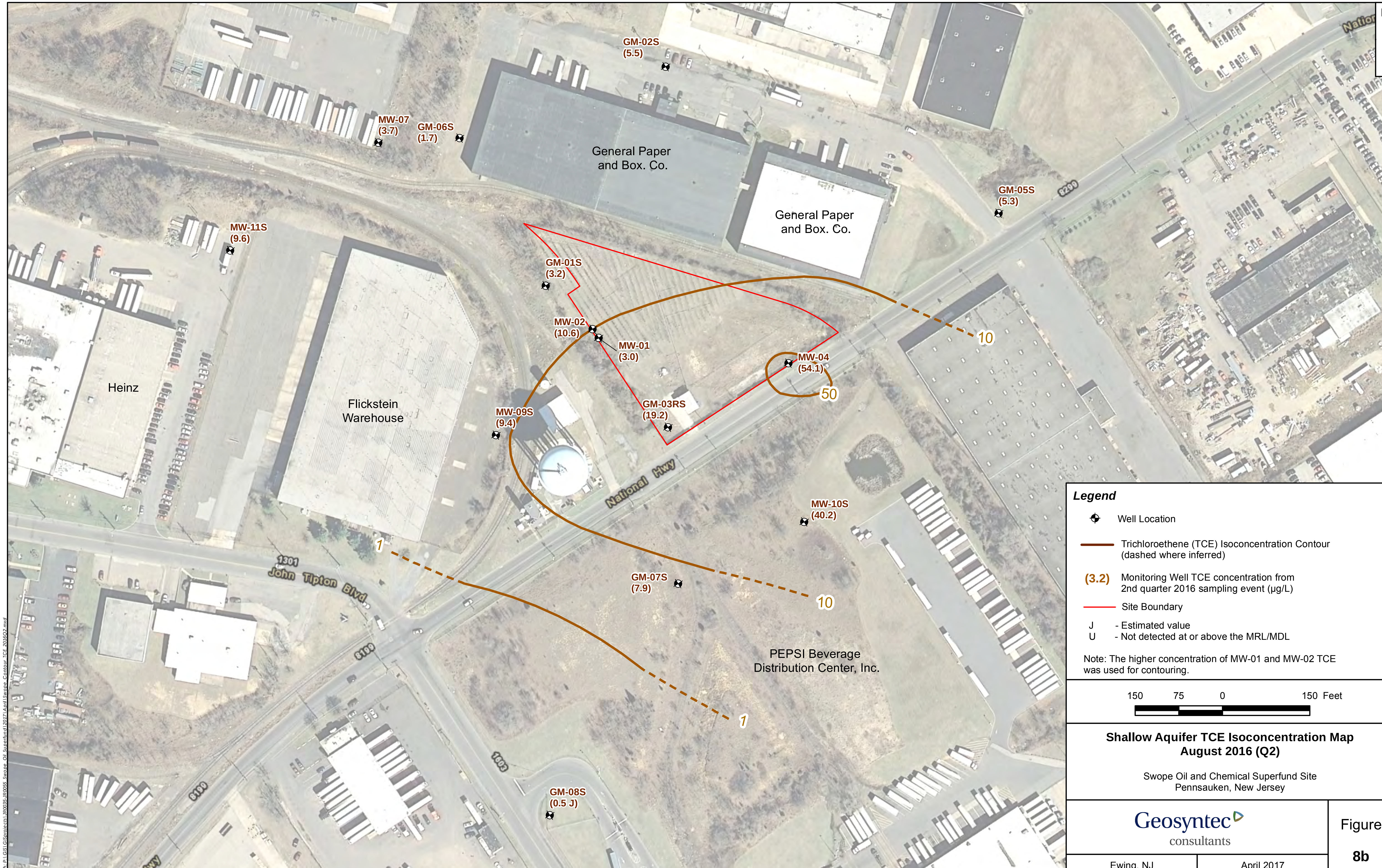
Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

Ewing, NJ | April 2017

Figure
7d


N
GM-02S
(3.1)
MW-07
(3.5)
GM-06S
(1.1)
General Paper
and Box. Co.
General Paper
and Box. Co.
GM-05S
(4.9)
MW-11S
(8.5)
GM-01S
(2.8)
MW-02
(2.1)
MW-01
(9.6)
MW-04
(48.2)
Heinz
Flickstein
Warehouse
MW-09S
(5.9)
GM-03RS
(19.8)
10
50
MW-10S
(109)
100
50
National Hwy
1
GM-07S
(8.7)
10
John Tipton Blvd
PEPSI Beverage
Distribution Center, Inc.
1
GM-08S
(0.61 J)
Legend
Well Location
Trichloroethene (TCE) Isoconcentration Contour
(dashed where inferred)
(3.2) Monitoring Well TCE concentration from
1st quarter 2016 sampling event (µg/L)
Site Boundary
J - Estimated value
U - Not detected at or above the MRL/MDL
Note: The higher concentration of MW-01 and MW-02 TCE
was used for contouring.
150 75 0 150 Feet
Shallow Aquifer TCE Isoconcentration Map
March 2016 (Q1)
Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey
Geosyntec
consultants
Ewing, NJ
April 2017
Figure
8a



Legend

Well Location

Trichloroethene (TCE) Isoconcentration Contour (dashed where inferred)

(3.2) Monitoring Well TCE concentration from 2nd quarter 2016 sampling event (µg/L)

Site Boundary

J - Estimated value

U - Not detected at or above the MRL/MDL

Note: The higher concentration of MW-01 and MW-02 TCE was used for contouring.

150 75 0 150 Feet

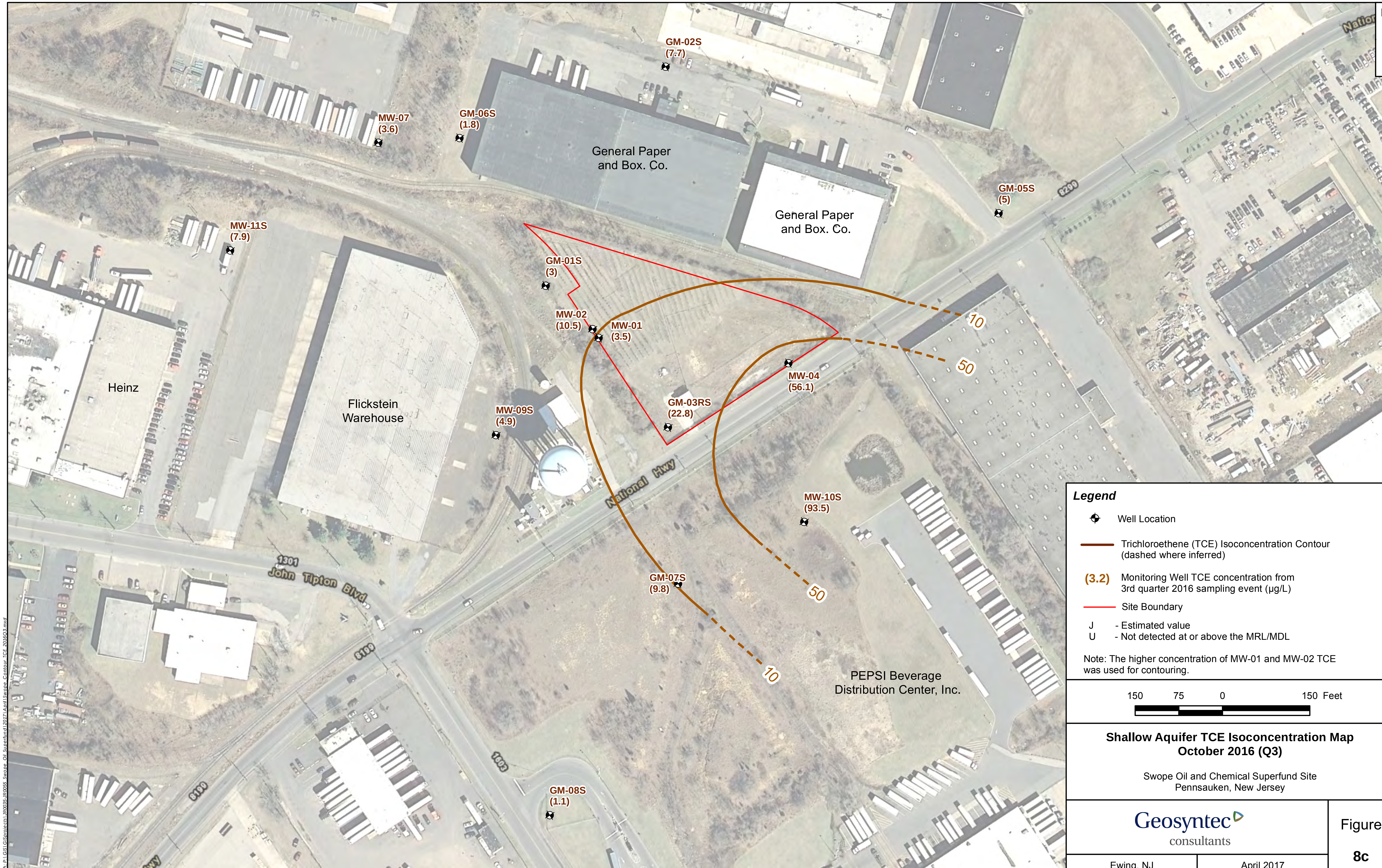
Shallow Aquifer TCE Isoconcentration Map
August 2016 (Q2)

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

Ewing, NJ | April 2017

Figure **8b**



Legend

Well Location

Trichloroethene (TCE) Isoconcentration Contour (dashed where inferred)

(3.2) Monitoring Well TCE concentration from 3rd quarter 2016 sampling event (µg/L)

Site Boundary

J - Estimated value
U - Not detected at or above the MRL/MDL

Note: The higher concentration of MW-01 and MW-02 TCE was used for contouring.

150 75 0 150 Feet

Shallow Aquifer TCE Isoconcentration Map
October 2016 (Q3)

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

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Figure **8c**

Legend

Well Location

Trichloroethene (TCE) Isoconcentration Contour (dashed where inferred)

(3.2) Monitoring Well TCE concentration from 4th quarter 2016 sampling event (µg/L)

Site Boundary

J - Estimated value
U - Not detected at or above the MRL/MDL

Note: The higher concentration of MW-01 and MW-02 TCE was used for contouring.

150 75 0 150 Feet

Shallow Aquifer TCE Isoconcentration Map
November/December 2016 (Q4)

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

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Figure **8d**

Legend

Well Location

Cis-1,2-Dichloroethene (cDCE) Isoconcentration Contour (dashed where inferred)

(3.2) Monitoring Well cDCE concentration from 1st quarter 2016 sampling event (µg/L)

Site Boundary

J - Estimated value

U - Not detected at or above the MRL/MDL

Note: The higher concentration of MW-01 and MW-02 cDCE was used for contouring.

150 75 0 150 Feet

Shallow Aquifer cDCE Isoconcentration Map
March 2016 (Q1)

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

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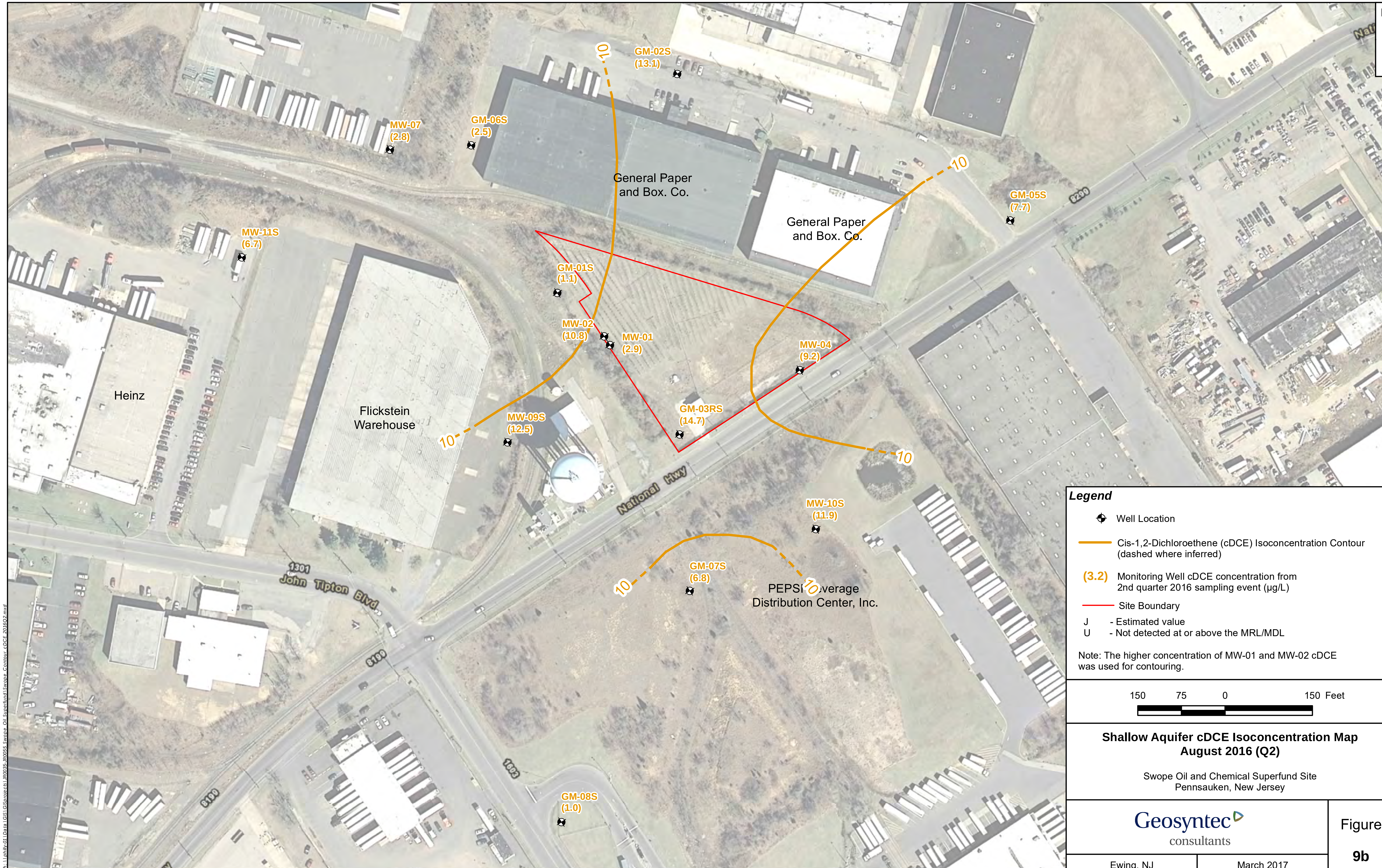
Figure **9a**



Shallow Aquifer cDCE Isoconcentration Map
August 2016 (Q2)

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

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Ewing, NJ | March 2017

Figure **9b**

Legend

Well Location

Cis-1,2-Dichloroethene (cDCE) Isoconcentration Contour (dashed where inferred)

(3.2) Monitoring Well cDCE concentration from 3rd quarter 2016 sampling event (µg/L)

Site Boundary

J - Estimated value

U - Not detected at or above the MRL/MDL

Note: The higher concentration of MW-01 and MW-02 cDCE was used for contouring.

150 75 0 150 Feet

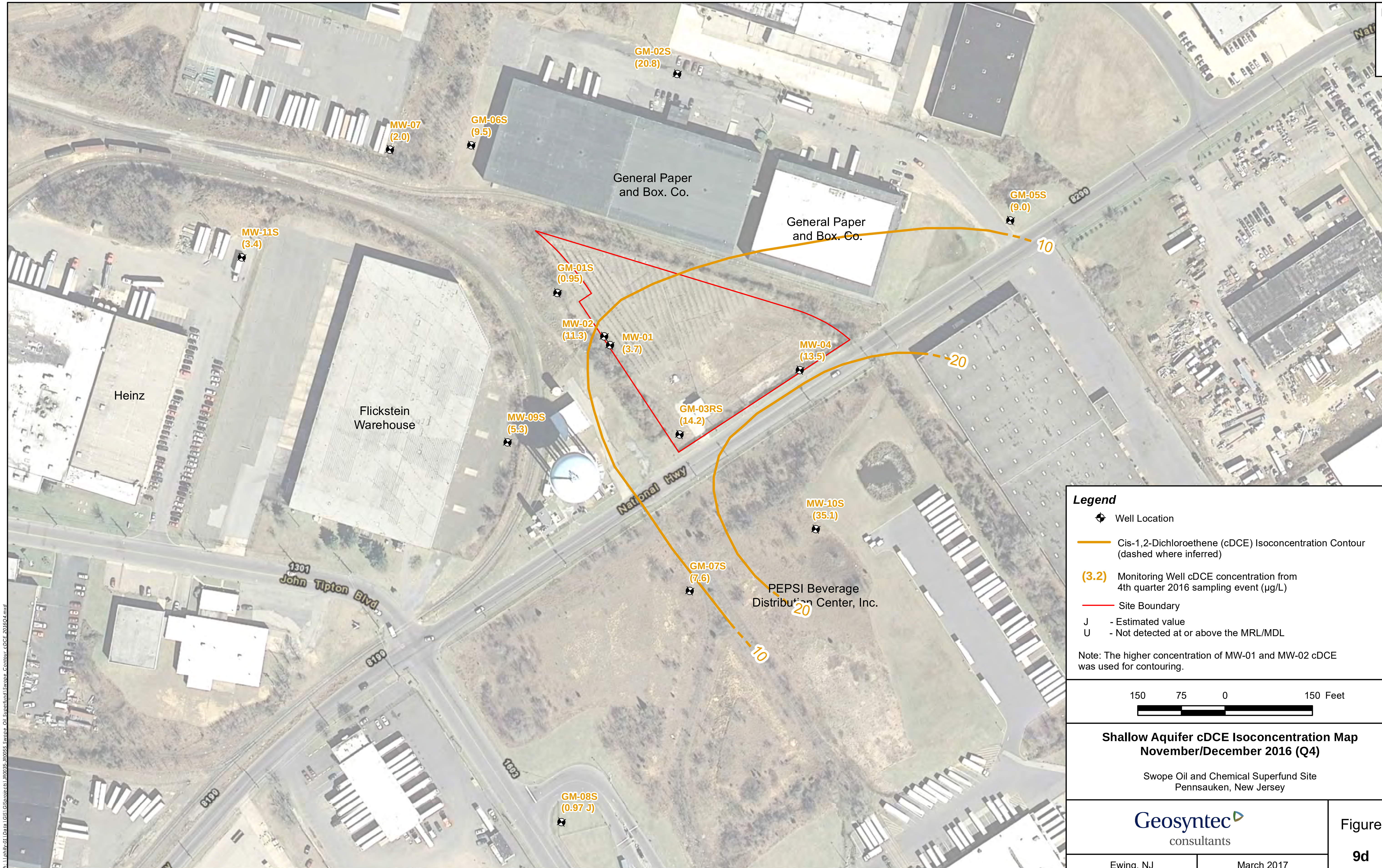
Shallow Aquifer cDCE Isoconcentration Map
October 2016 (Q3)

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

Figure **9c**

Ewing, NJ | March 2017



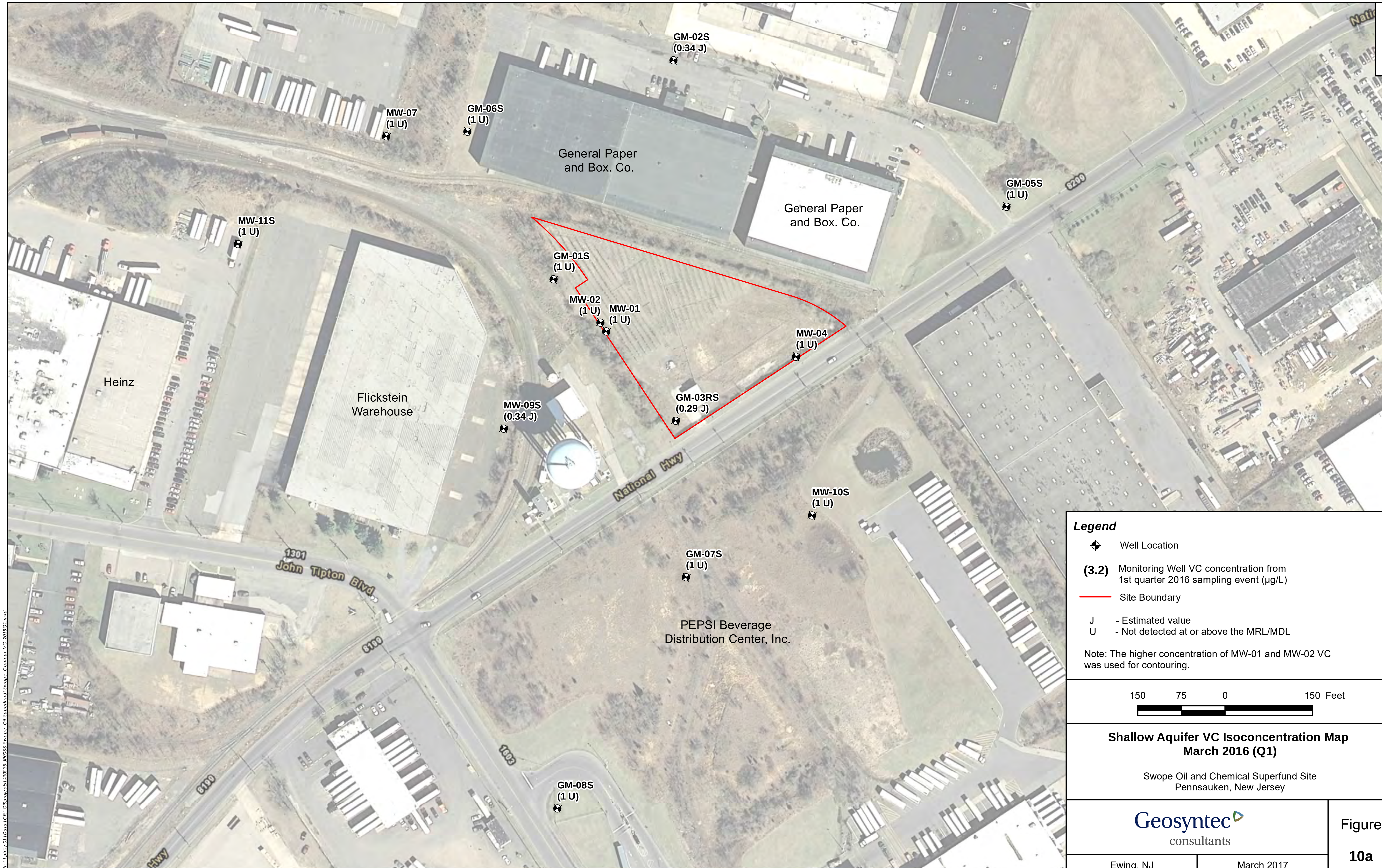
Shallow Aquifer cDCE Isoconcentration Map
November/December 2016 (Q4)

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

Ewing, NJ | March 2017

Figure **9d**



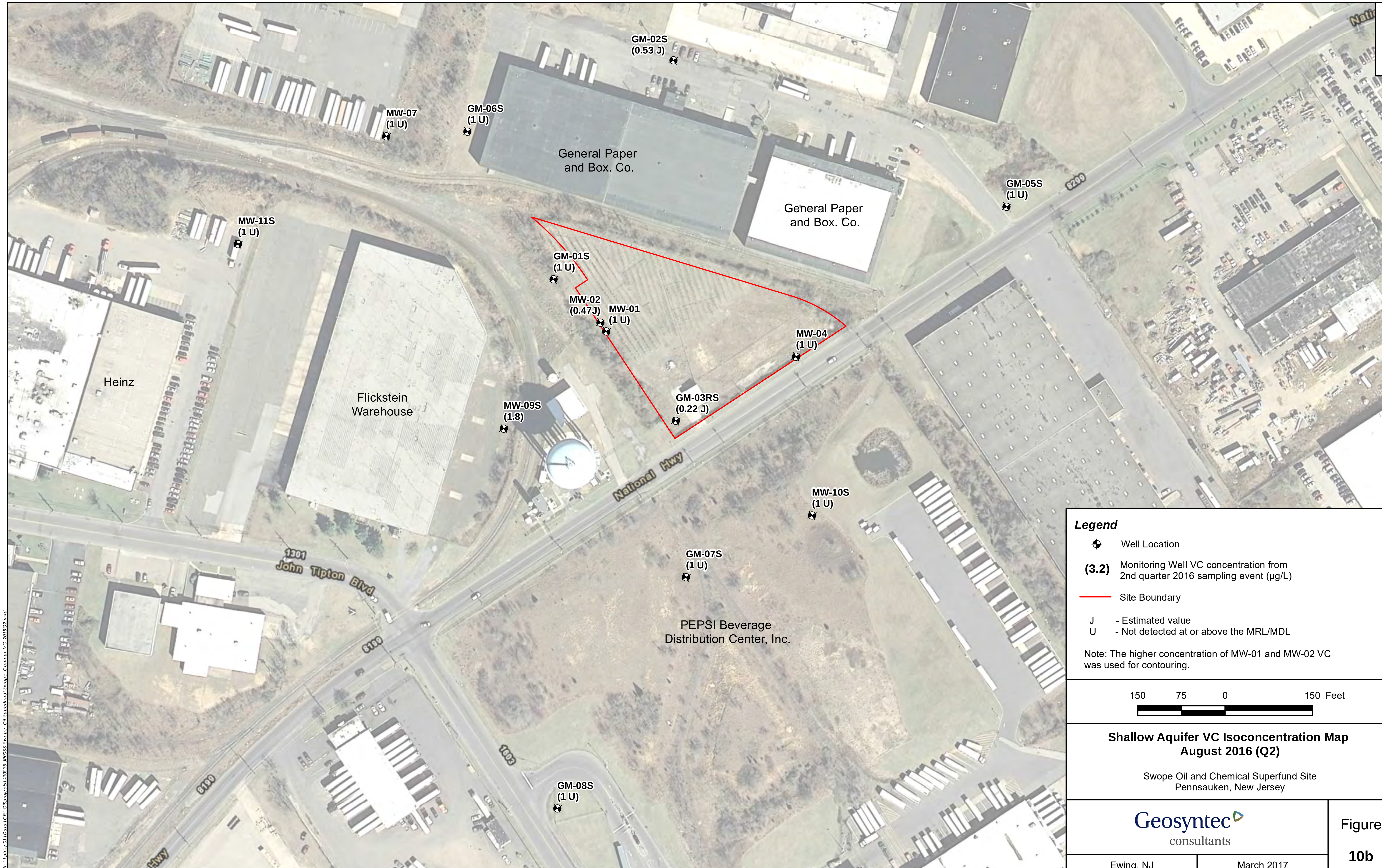
Shallow Aquifer VC Isoconcentration Map
March 2016 (Q1)

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

Ewing, NJ | March 2017

Figure **10a**

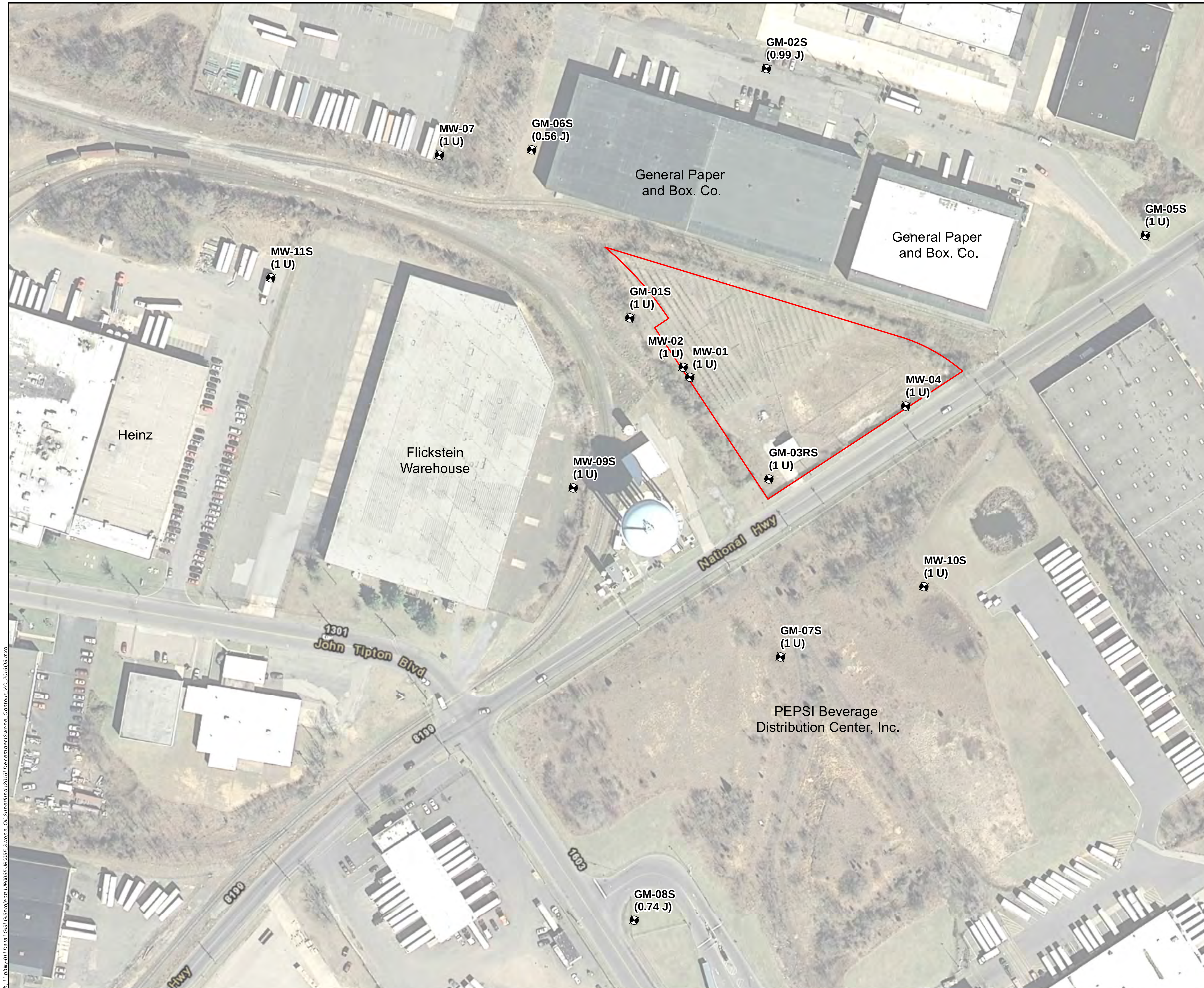


Shallow Aquifer VC Isoconcentration Map
August 2016 (Q2)

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

Ewing, NJ	March 2017	Figure 10b



Legend

Well Location

(3.2) Monitoring Well VC concentration from 3rd quarter 2016 sampling event (µg/L)

Site Boundary

J - Estimated value

U - Not detected at or above the MRL/MDL

Note: The higher concentration of MW-01 and MW-02 VC was used for contouring.

150 75 0 150 Feet

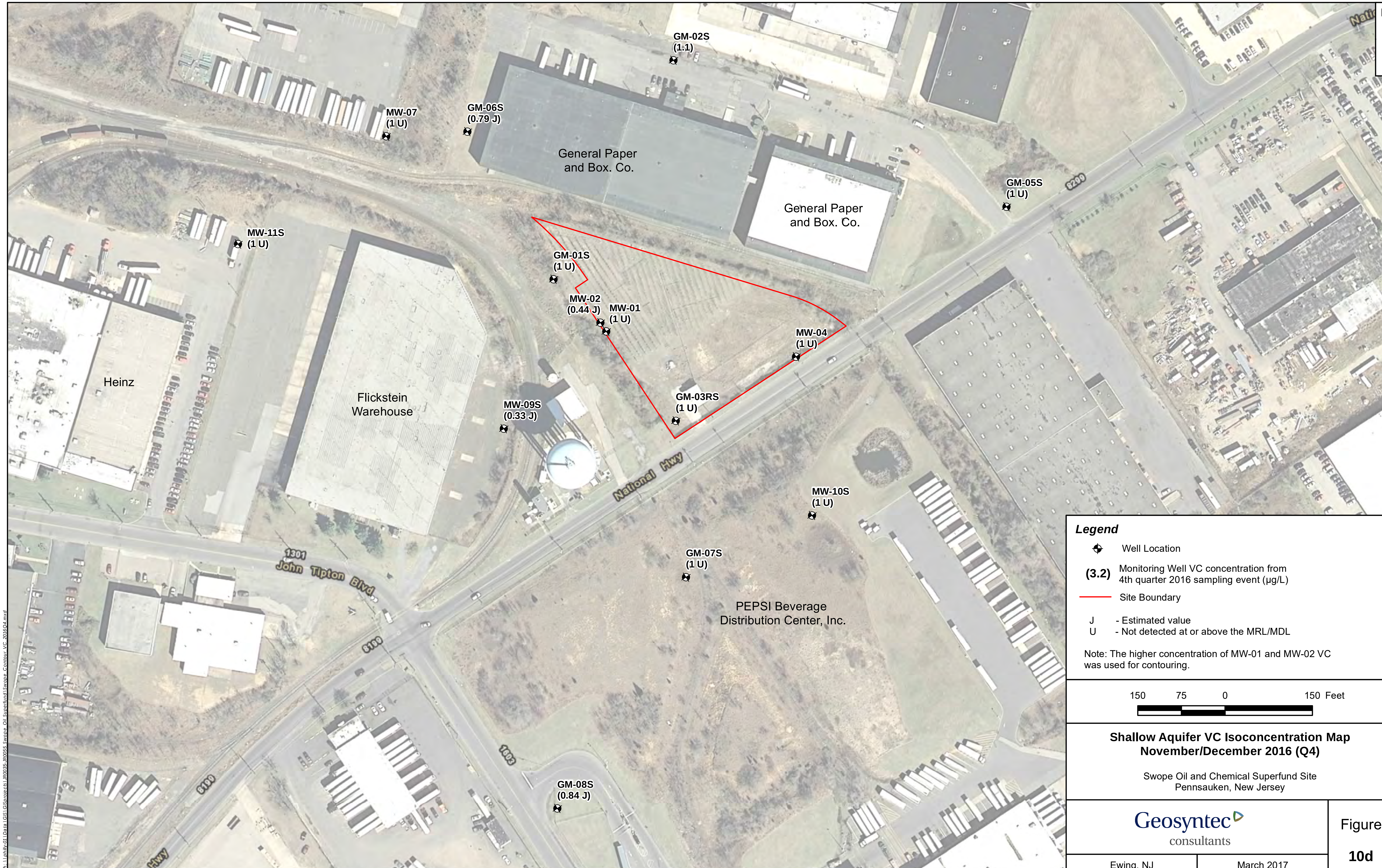
Shallow Aquifer VC Isoconcentration Map
October 2016 (Q3)

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

Geosyntec consultants

Ewing, NJ | March 2017

Figure **10c**



Shallow Aquifer VC Isoconcentration Map
November/December 2016 (Q4)

Swope Oil and Chemical Superfund Site
Pennsauken, New Jersey

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Figure **10d**

Figure 11a: Highest PCE Shallow Groundwater Concentration by Monitoring Well Hydraulic Position since 2012

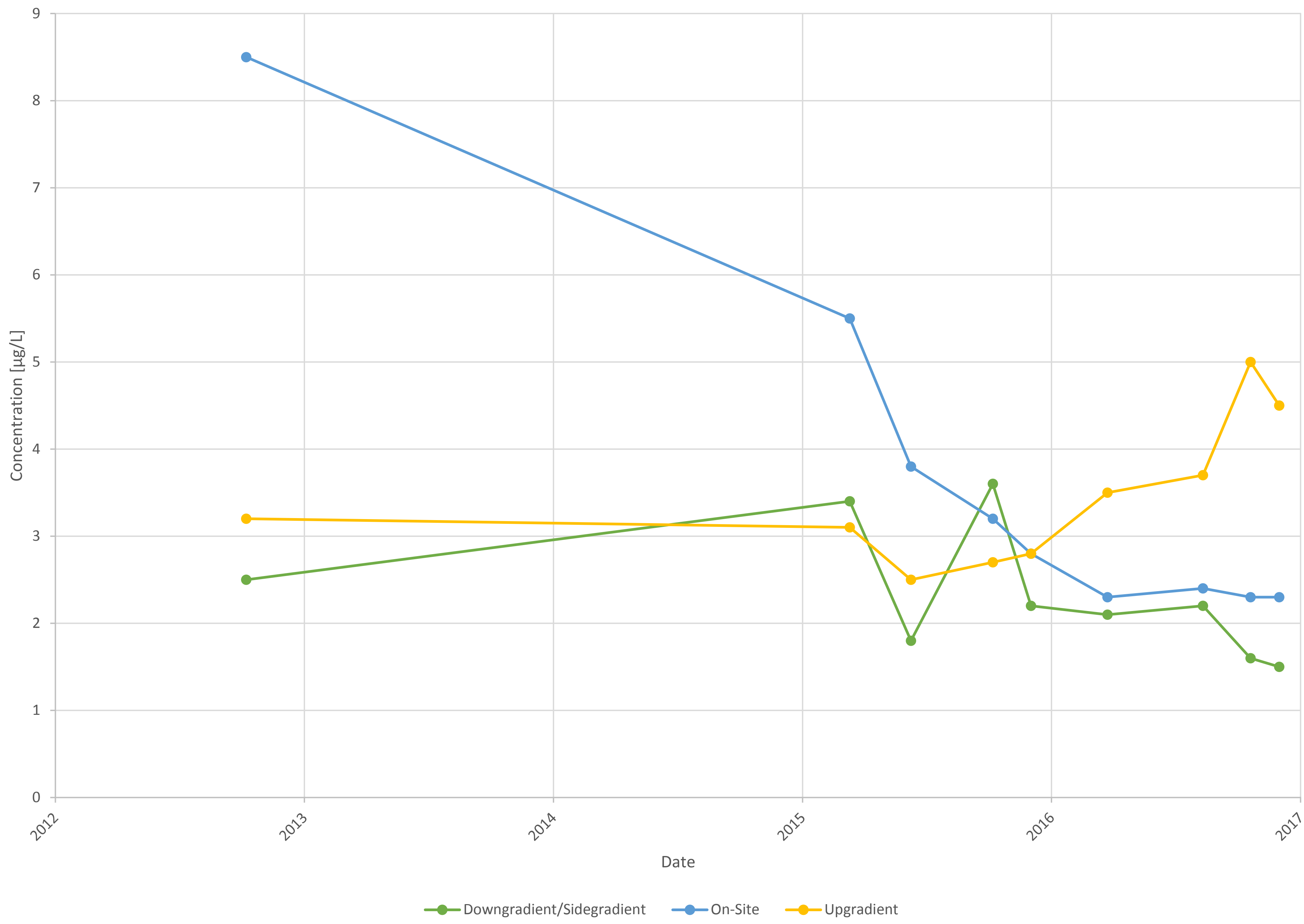
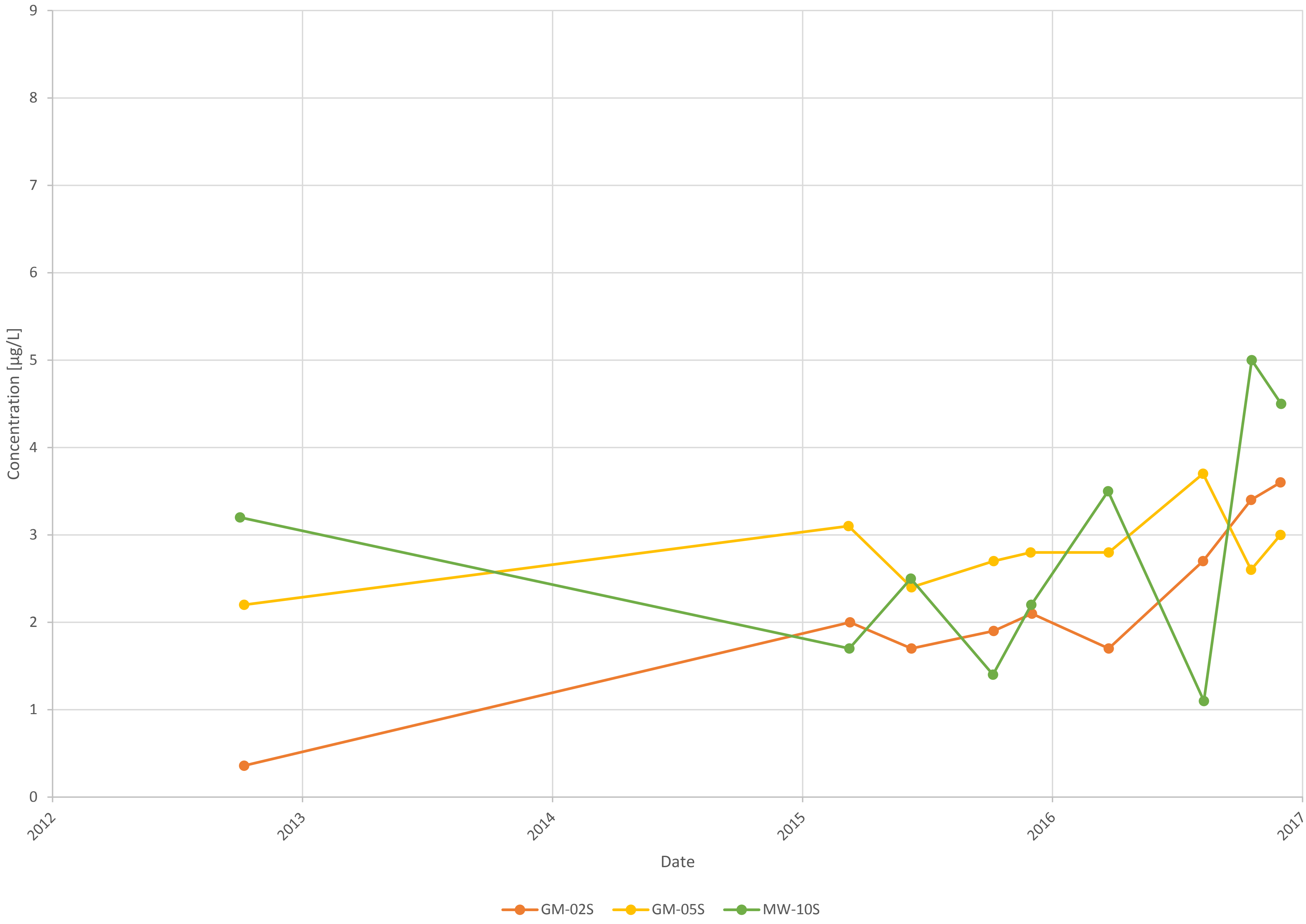


Figure 11b: Upgradient Monitoring Wells
PCE Shallow Groundwater Concentrations since 2012



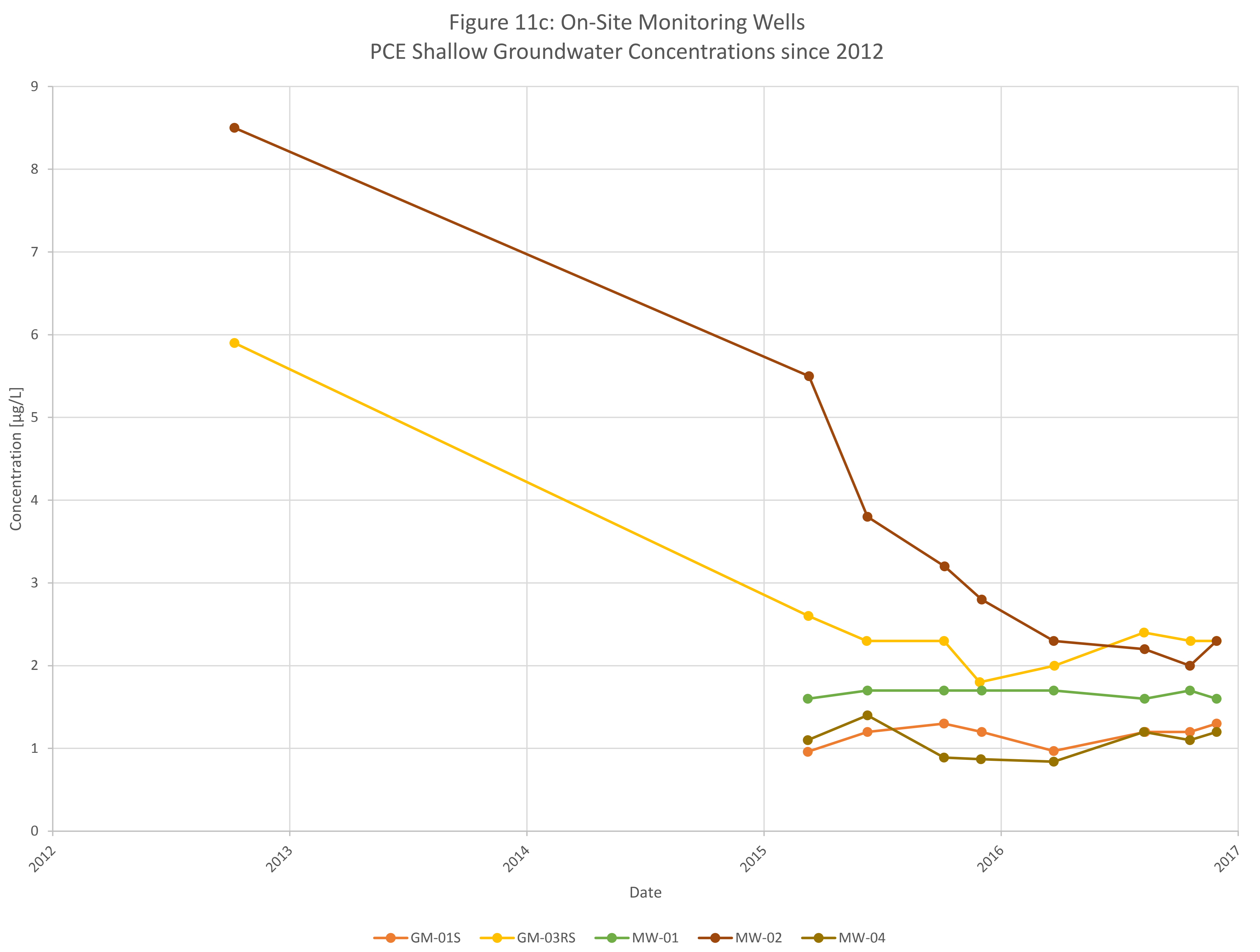


Figure 11c: On-Site Monitoring Wells
PCE Shallow Groundwater Concentrations since 2012
Concentration [µg/L]
0
1
2
3
4
5
6
7
8
9
2012
2013
2014
2015
2016
2017
Date
GM-01S
GM-03RS
MW-01
MW-02
MW-04

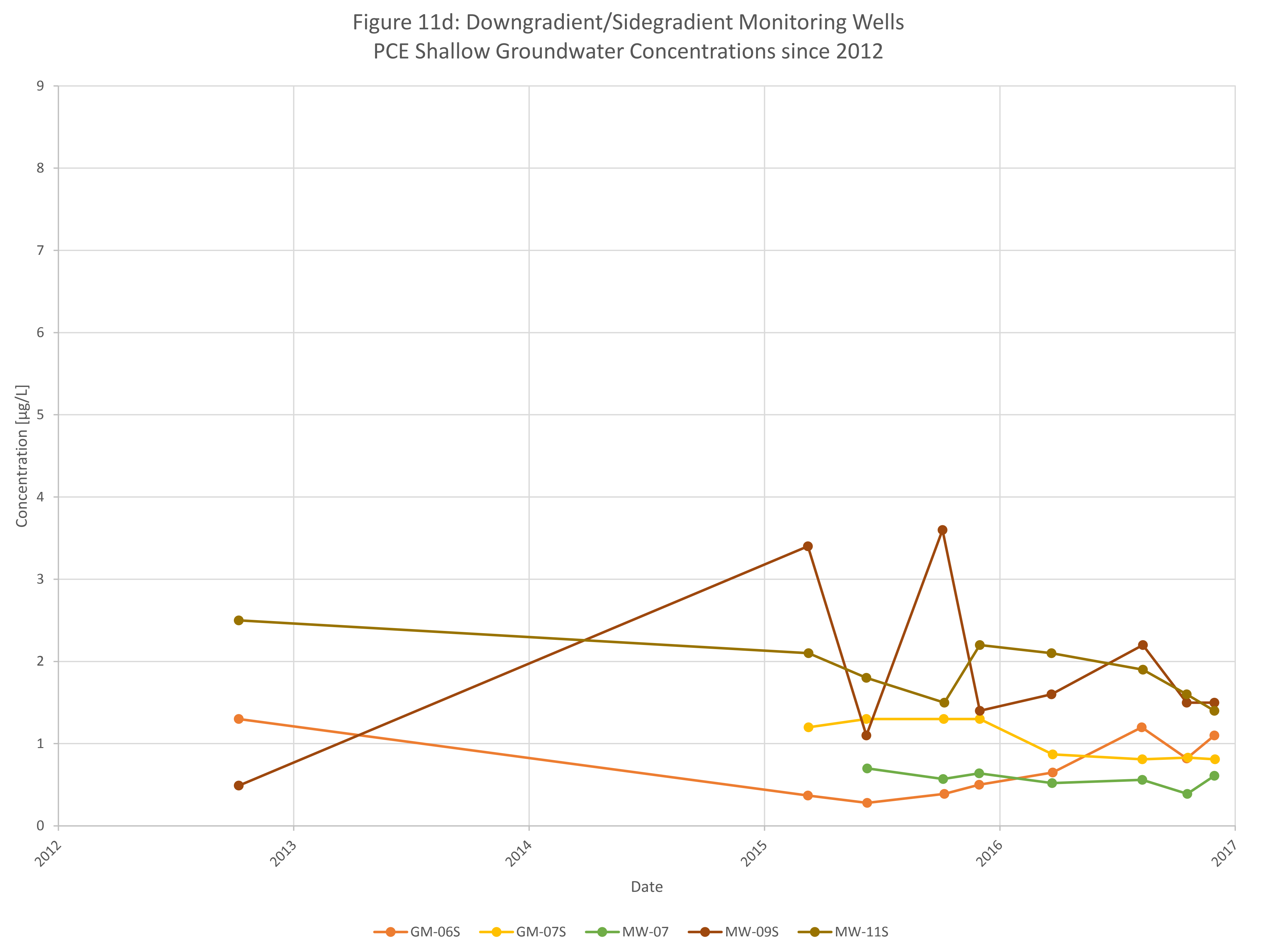


Figure 11d: Downgradient/Sidegradient Monitoring Wells
PCE Shallow Groundwater Concentrations since 2012
Concentration [µg/L]
0
1
2
3
4
5
6
7
8
9
2012
2013
2014
2015
2016
2017
Date
GM-06S
GM-07S
MW-07
MW-09S
MW-11S

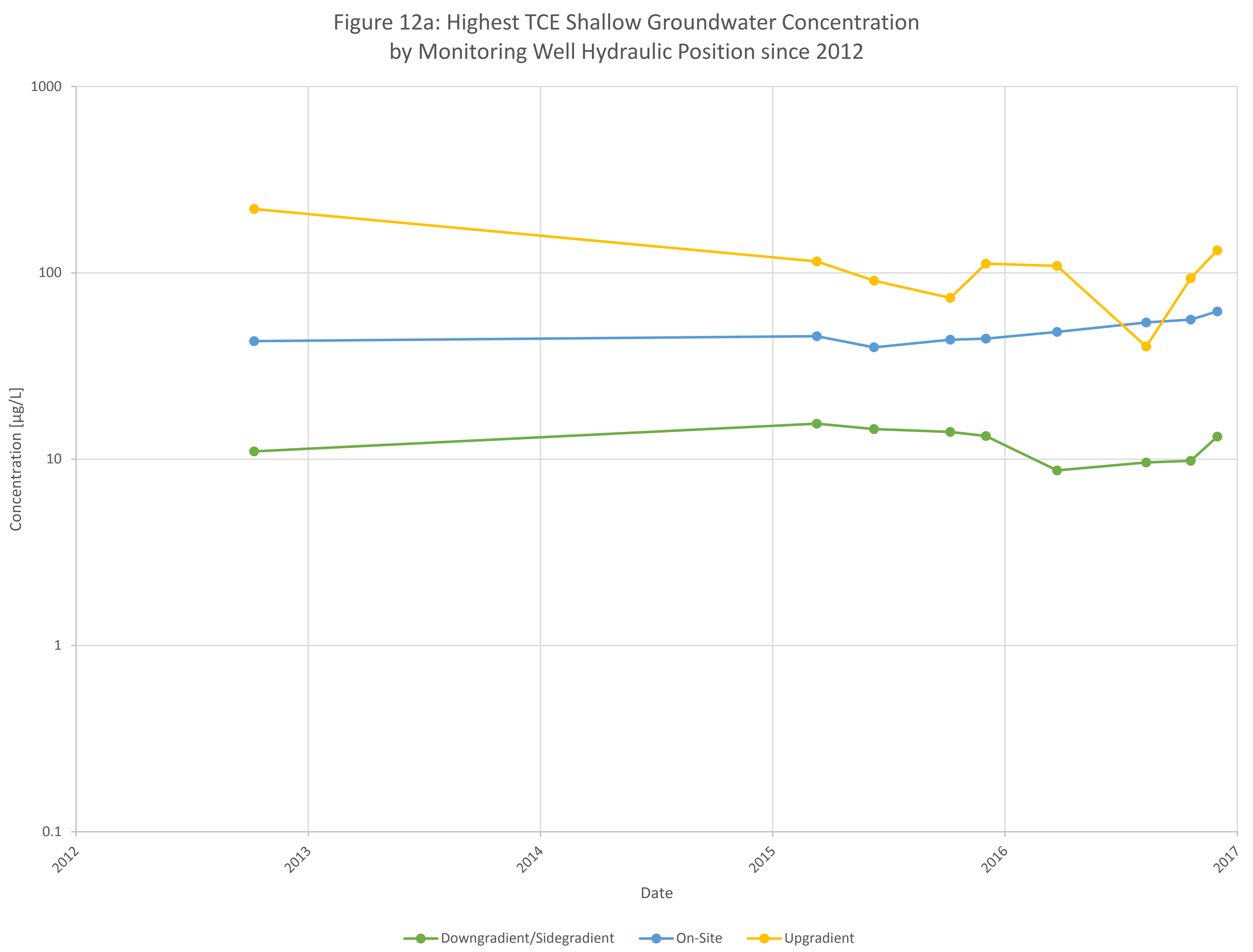


Figure 12a: Highest TCE Shallow Groundwater Concentration
by Monitoring Well Hydraulic Position since 2012
1000
100
10
1
0.1
Concentration [µg/L]
2012
2013
2014
2015
2016
2017
Date
Downgradient/Sidegradient
On-Site
Upgradient

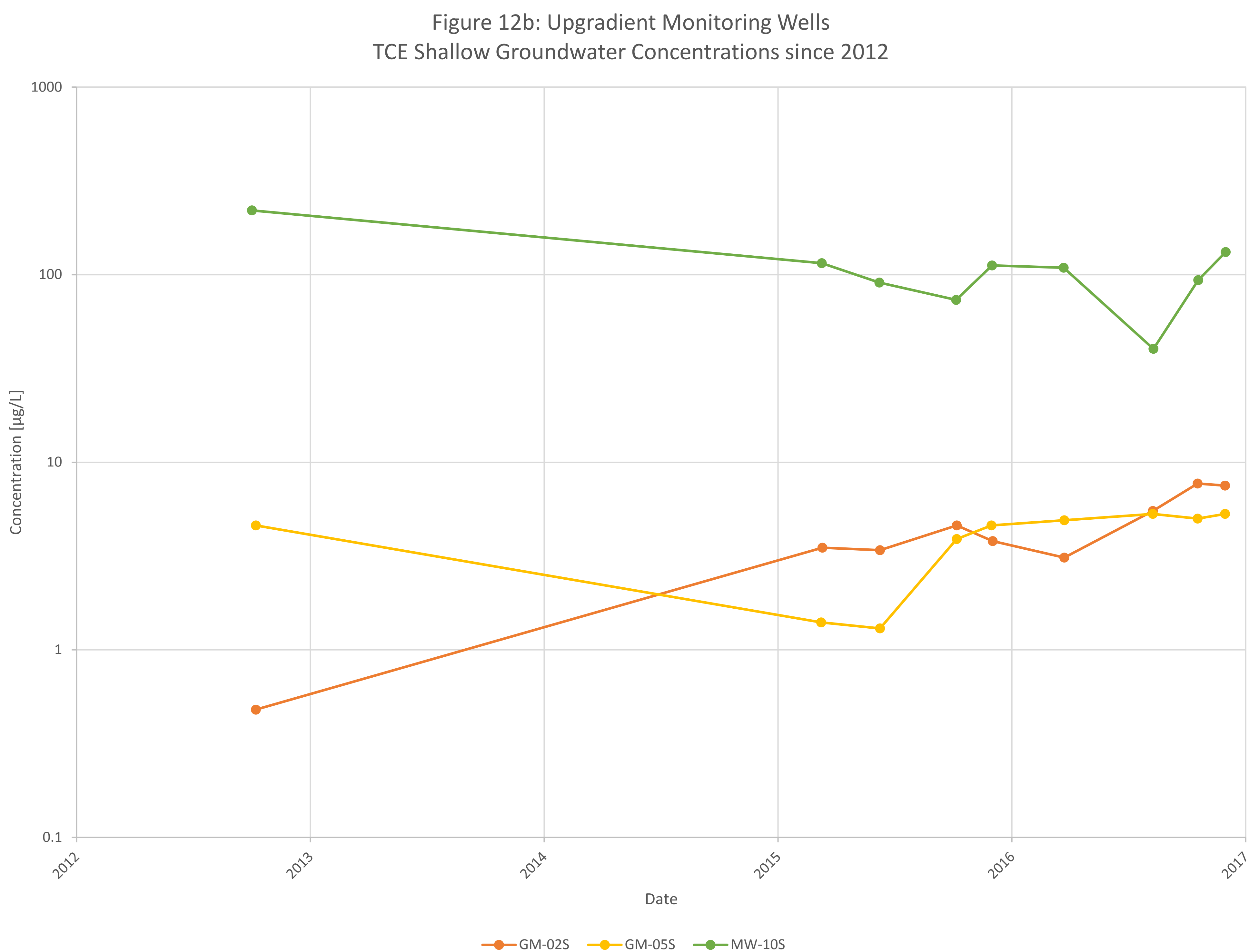


Figure 12b: Upgradient Monitoring Wells
TCE Shallow Groundwater Concentrations since 2012
1000
100
10
1
0.1
Concentration [µg/L]
2012
2013
2014
2015
2016
2017
Date
GM-02S
GM-05S
MW-10S

Figure 12c: On-Site Monitoring Wells
TCE Shallow Groundwater Concentrations since 2012

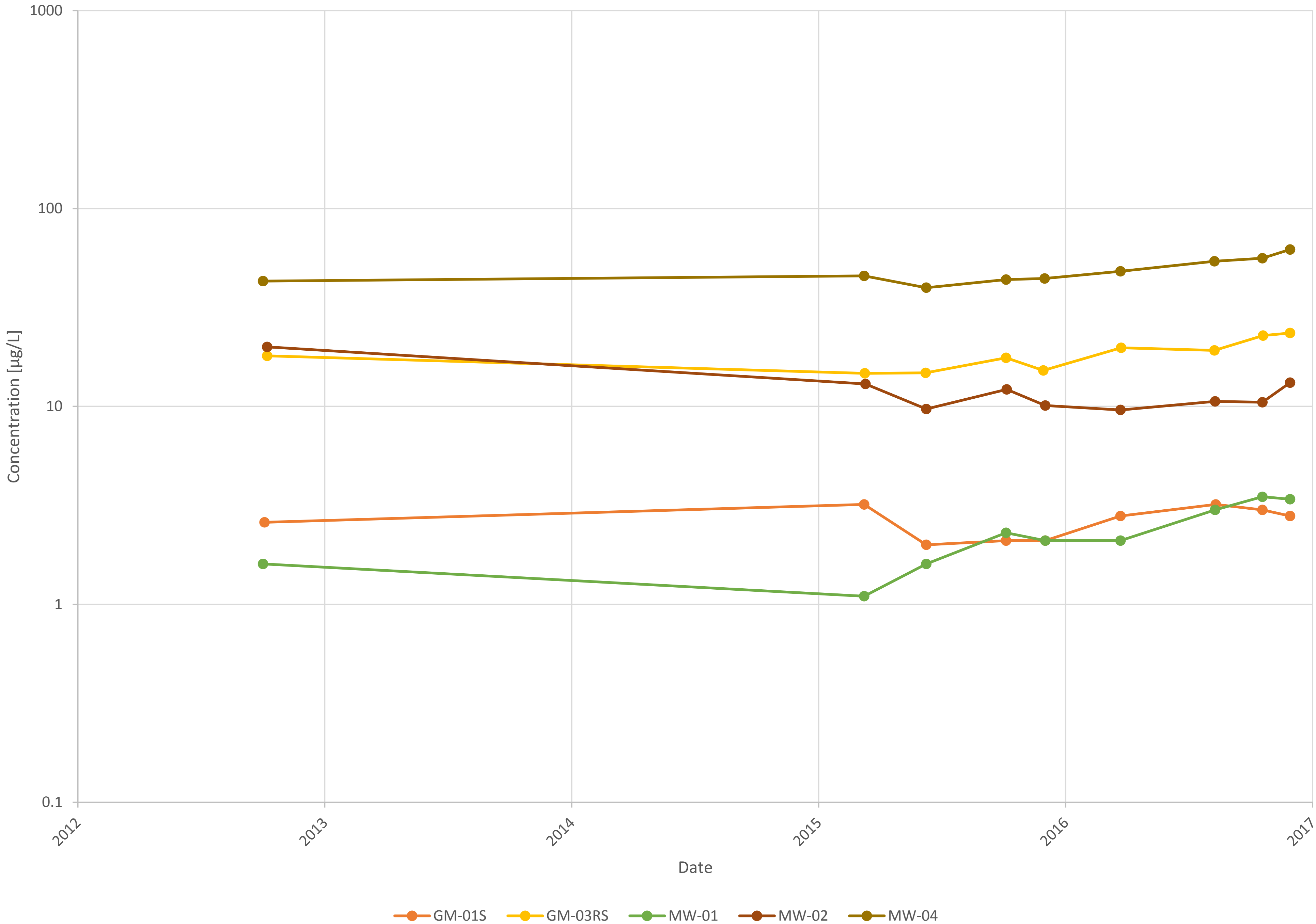
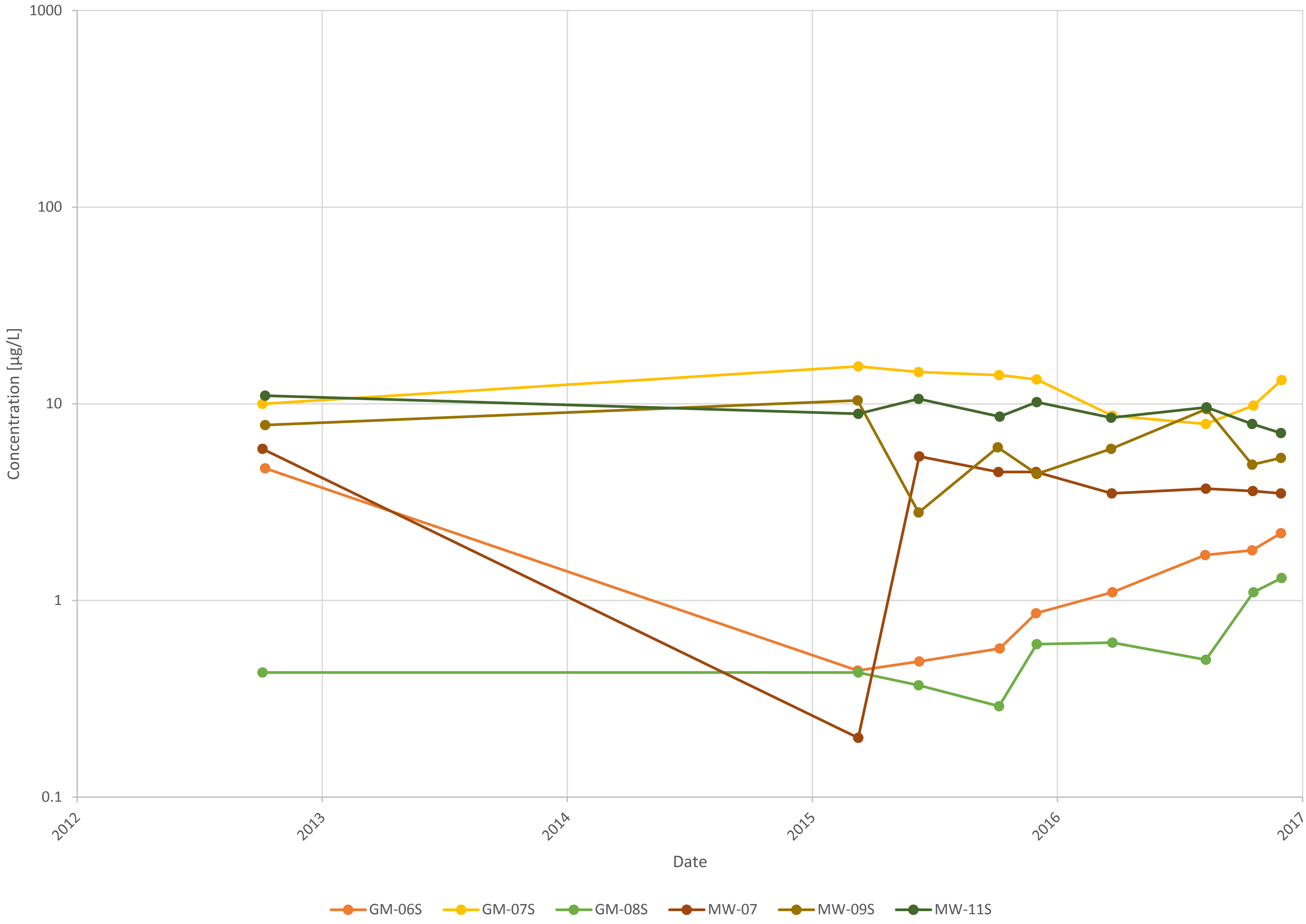


Figure 12d: Downgradient/Sidegradient Monitoring Wells
TCE Shallow Groundwater Concentrations since 2012



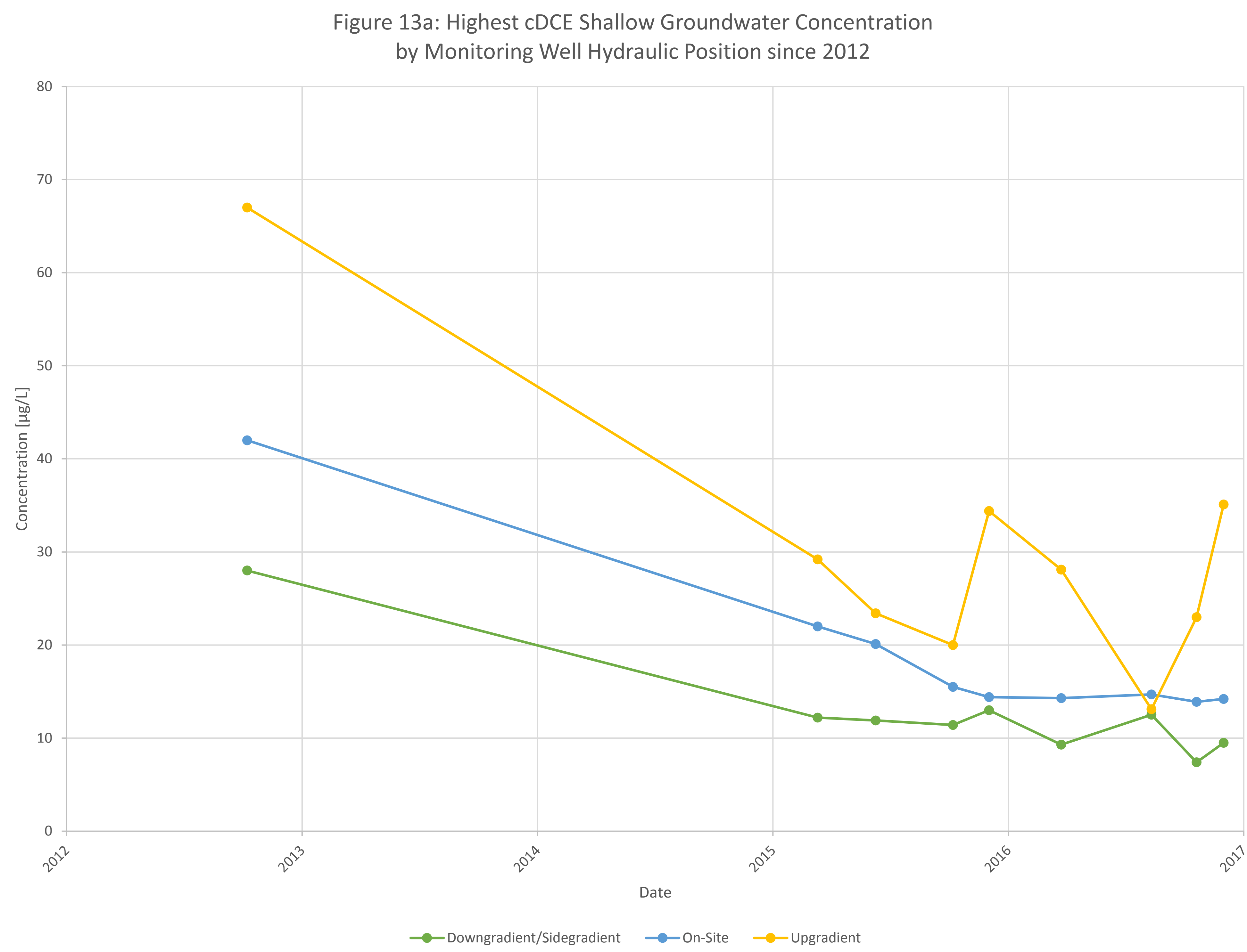


Figure 13a: Highest cDCE Shallow Groundwater Concentration
by Monitoring Well Hydraulic Position since 2012
Concentration [µg/L]
80
70
60
50
40
30
20
10
0
2012
2013
2014
2015
2016
2017
Date
Downgradient/Sidegradient
On-Site
Upgradient

Figure 13b: Upgradient Monitoring Wells
cDCE Shallow Groundwater Concentrations since 2012

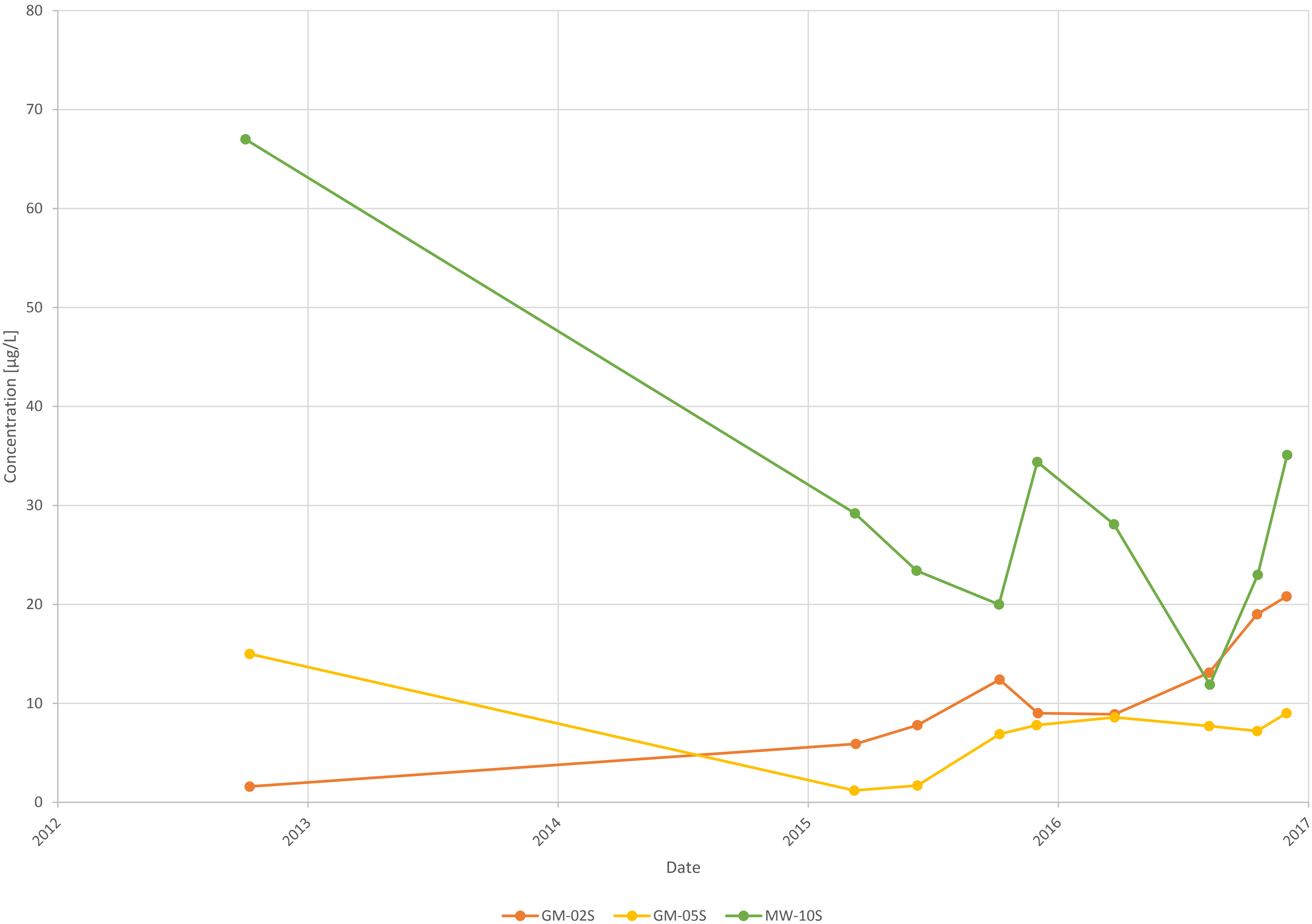
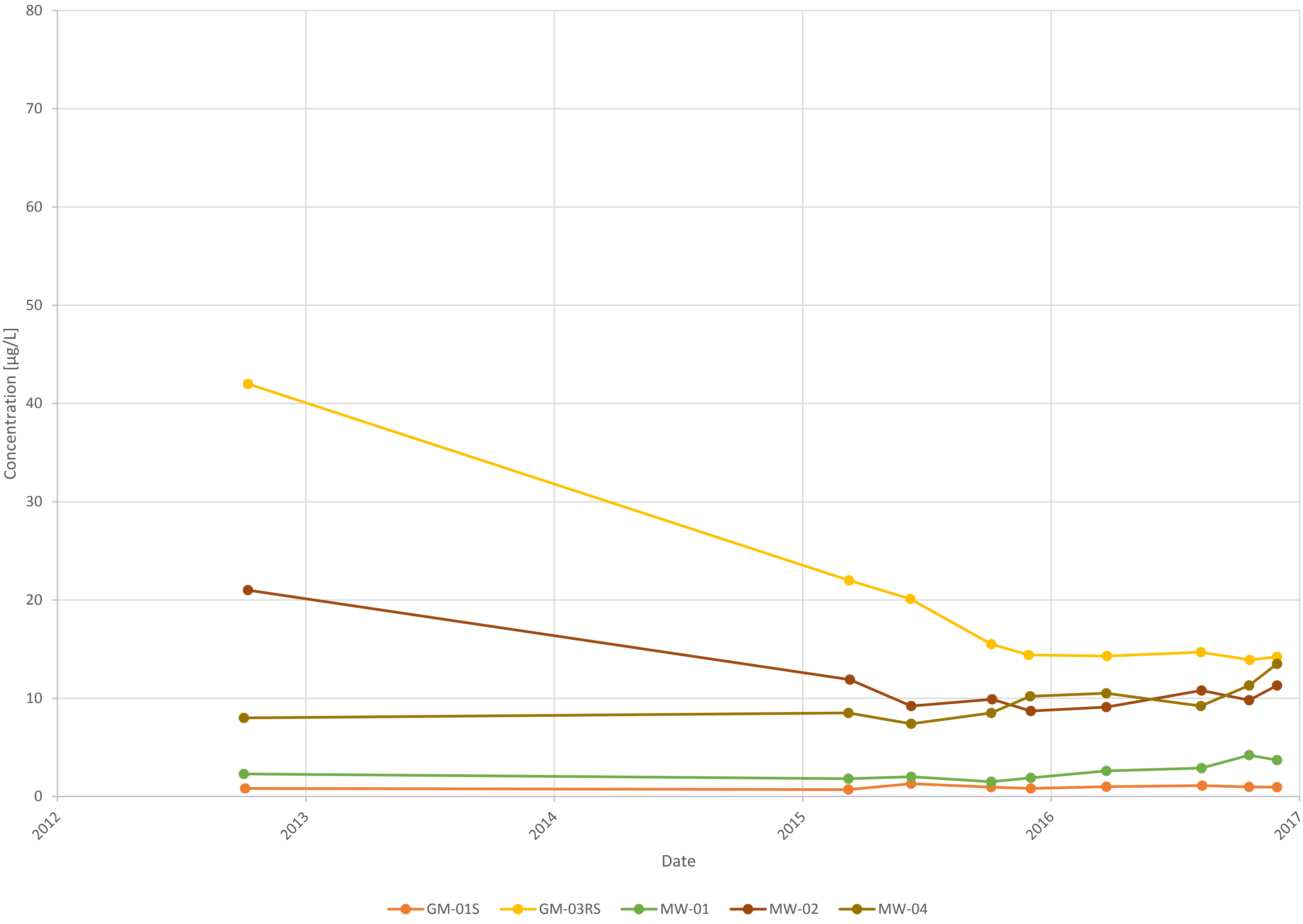


Figure 13c: On-Site Monitoring Wells
cDCE Shallow Groundwater Concentrations since 2012



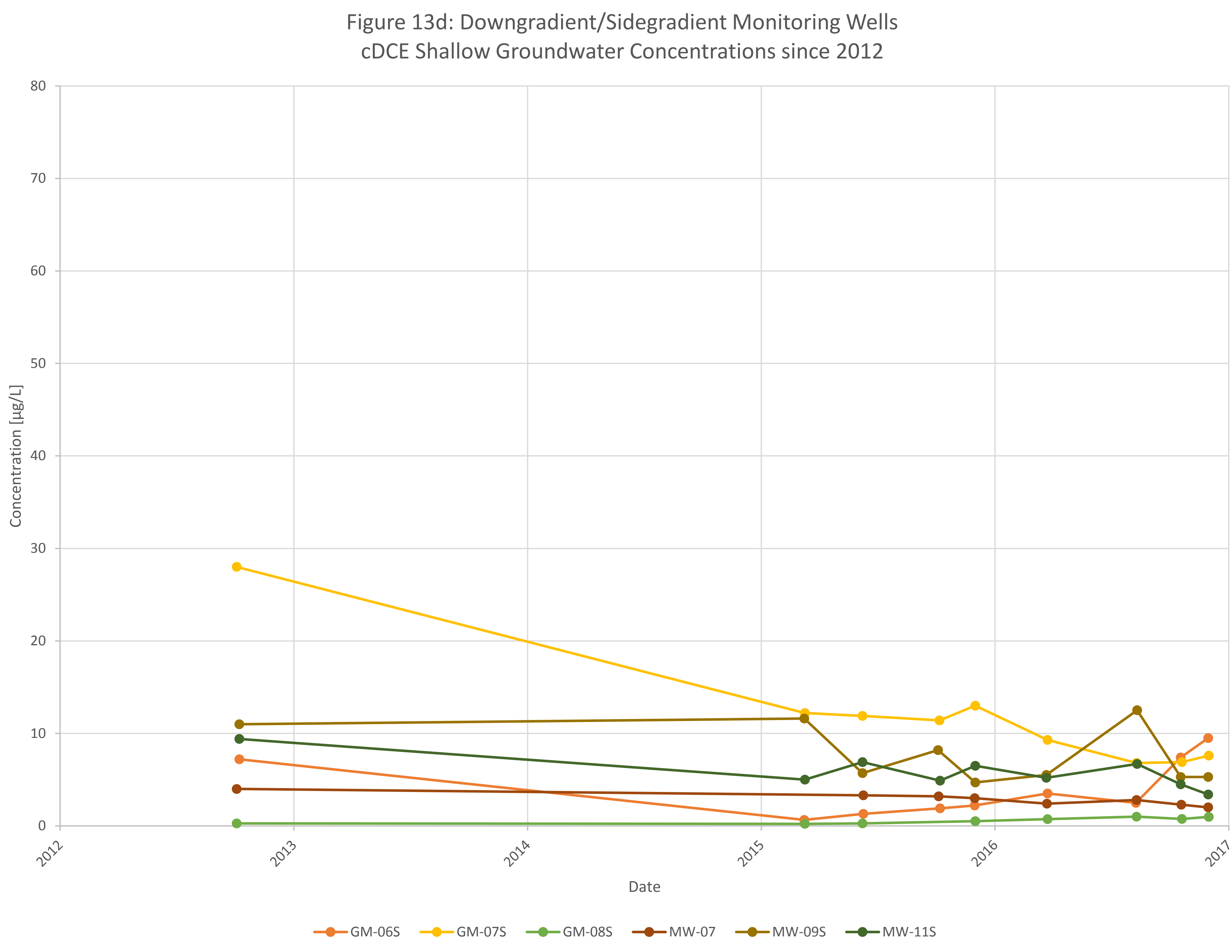


Figure 13d: Downgradient/Sidegradient Monitoring Wells
cDCE Shallow Groundwater Concentrations since 2012
Concentration [µg/L]
0
10
20
30
40
50
60
70
80
2012
2013
2014
2015
2016
2017
Date
GM-06S
GM-07S
GM-08S
MW-07
MW-09S
MW-11S

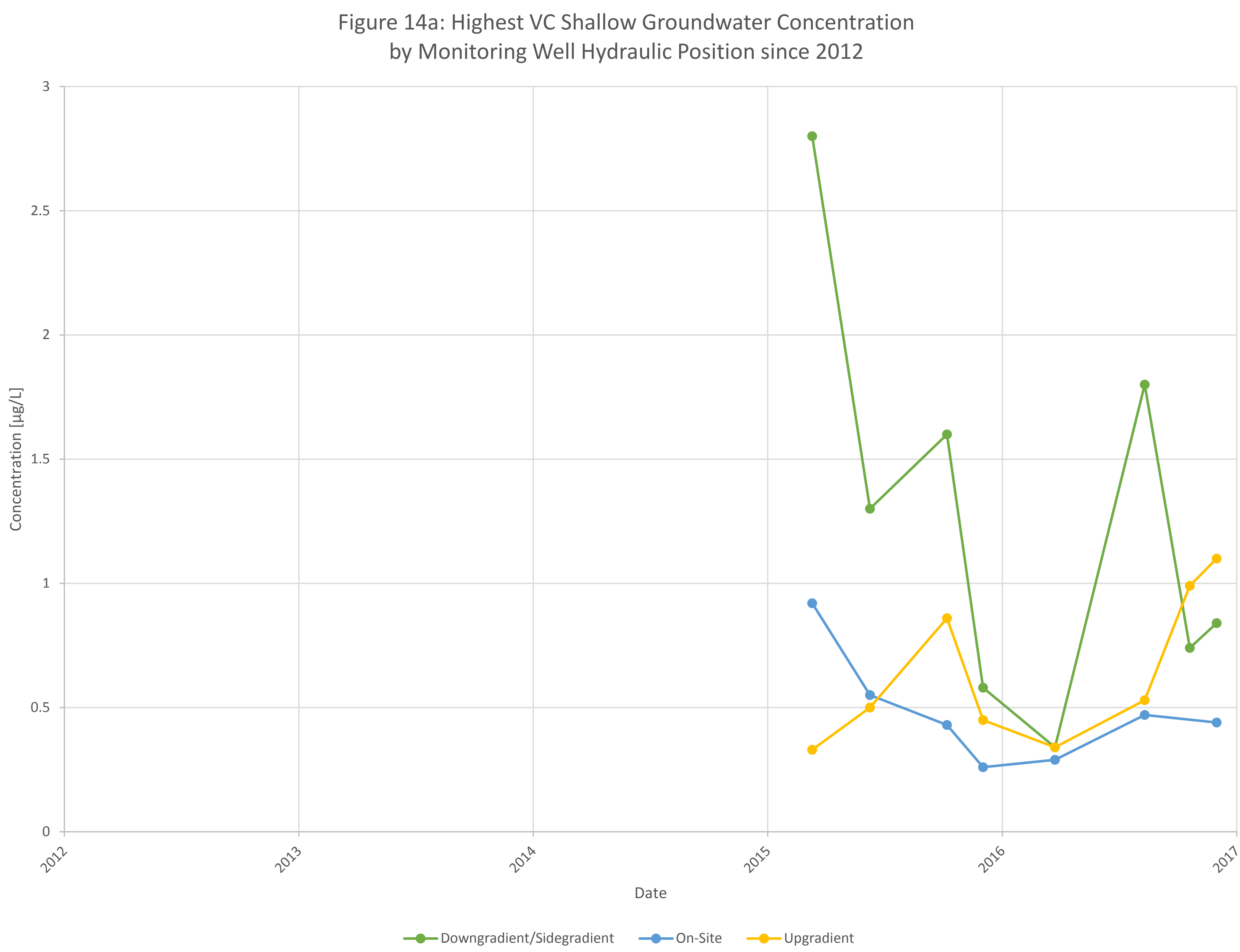


Figure 14a: Highest VC Shallow Groundwater Concentration
by Monitoring Well Hydraulic Position since 2012
Concentration [µg/L]
3
2.5
2
1.5
1
0.5
0
2012
2013
2014
2015
2016
2017
Date
Downgradient/Sidegradient
On-Site
Upgradient

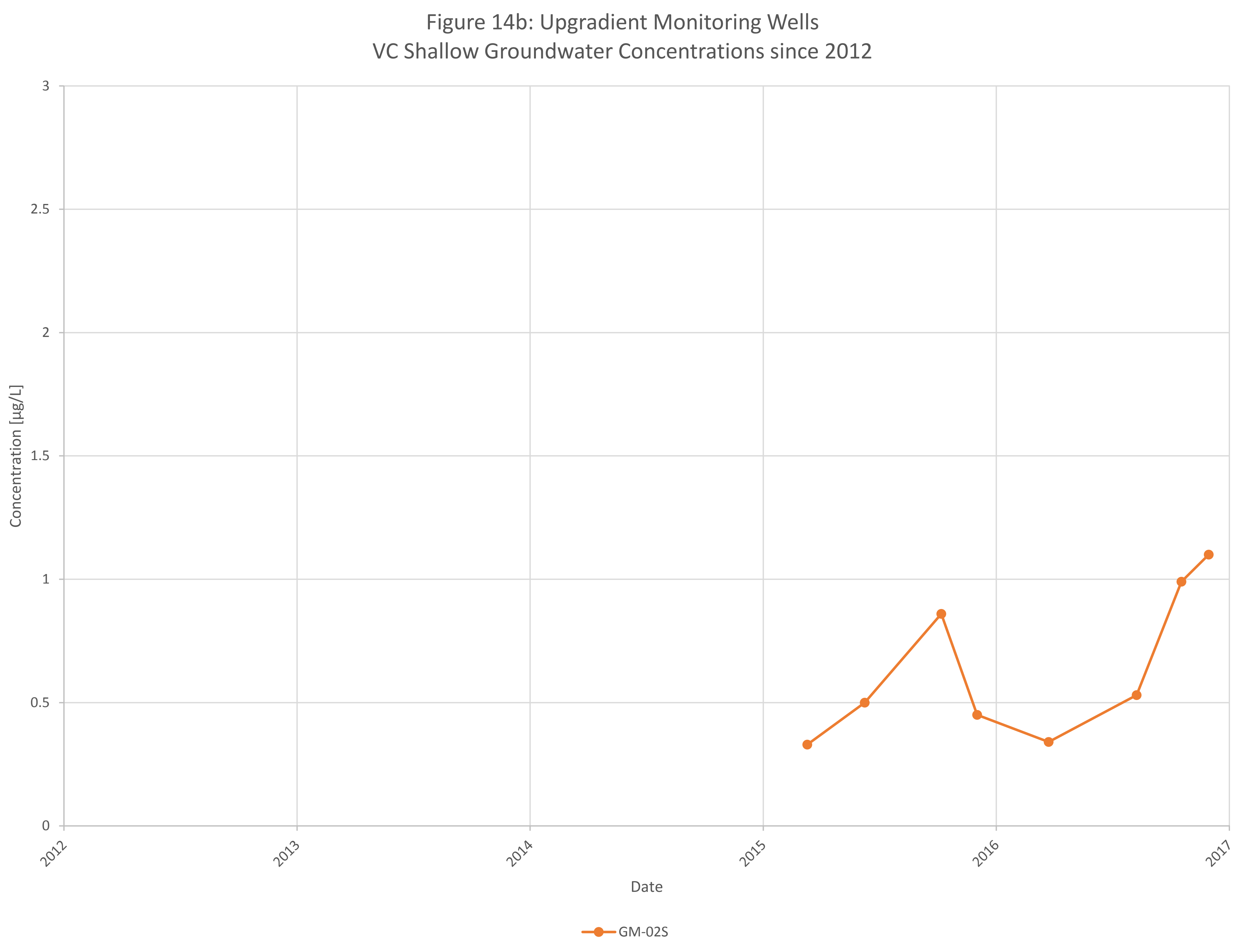
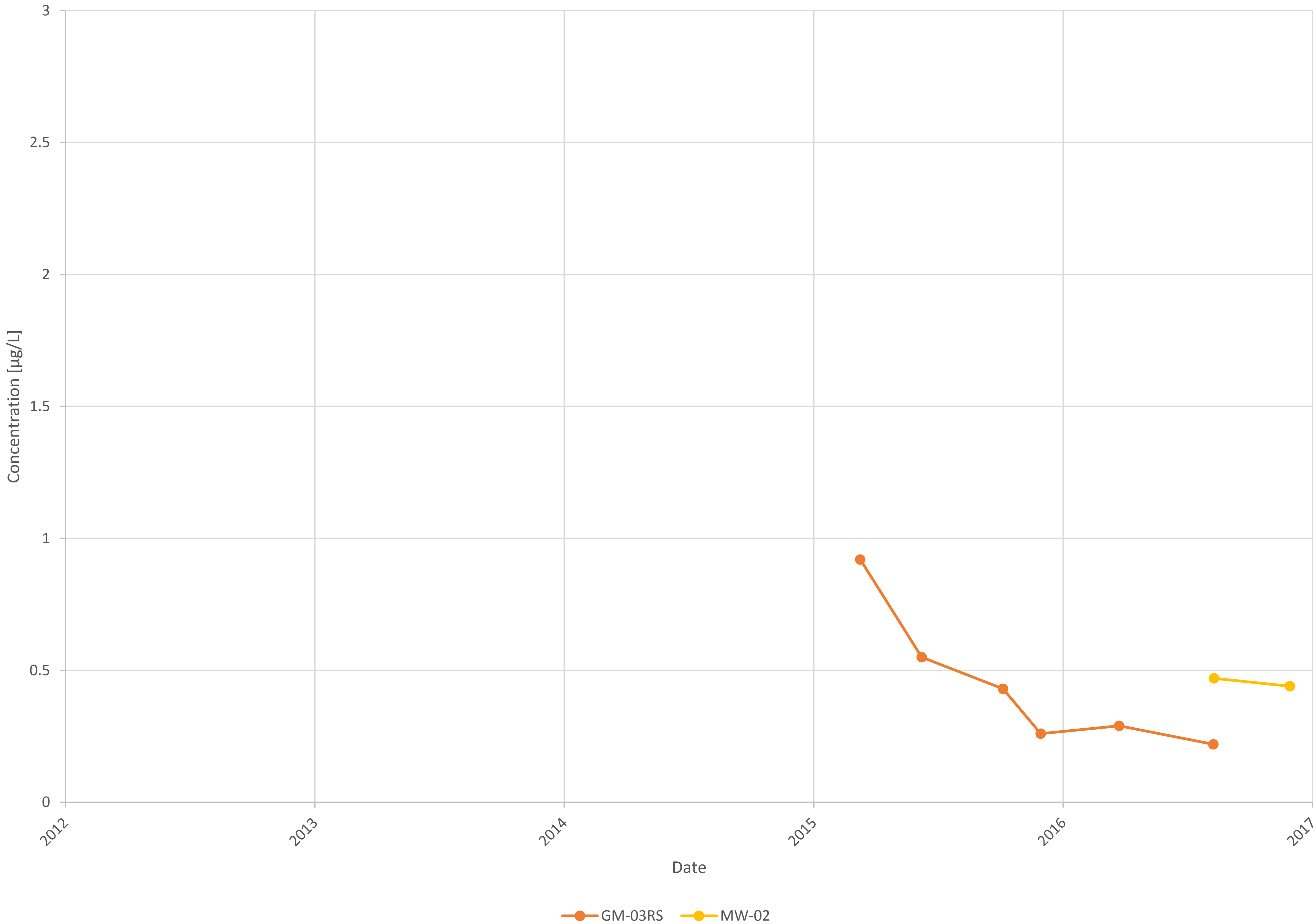


Figure 14b: Upgradient Monitoring Wells
VC Shallow Groundwater Concentrations since 2012
Concentration [µg/L]
0
0.5
1
1.5
2
2.5
3
2012
2013
2014
2015
2016
2017
Date
GM-02S

Figure 14c: On-Site Monitoring Wells
VC Shallow Groundwater Concentrations since 2012



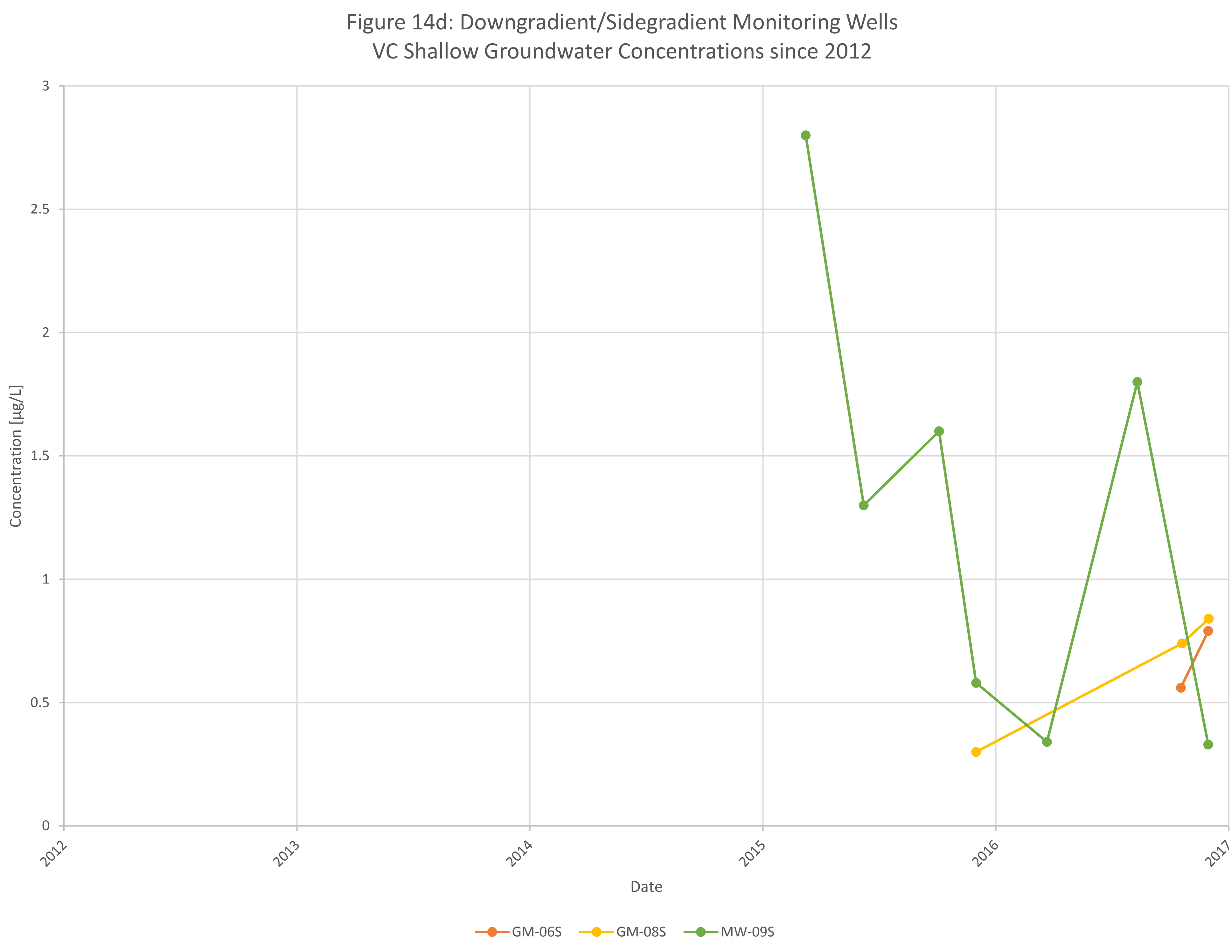


Figure 14d: Downgradient/Sidegradient Monitoring Wells
VC Shallow Groundwater Concentrations since 2012
Concentration [µg/L]
0
0.5
1
1.5
2
2.5
3
2012
2013
2014
2015
2016
2017
Date
GM-06S
GM-08S
MW-09S